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A GROUND BASED RIGHT CIRCULARLY POLARIZED
TRI-HELIX TELEMETRY ANTENNA ARRAY FOR
THE 225 TO 250 MC/SEC FREQUENCY BAND

September 1963

Project Director

H. W. Haas

Project Engineer

G. E. Johnson

Contract No. NAS 5-3318



FACILITY FORM: 6-32

N66-19651

(ACCESSION NO. SER.)

(THRU)

107

(PAGES)

(CODE)

CR 70711

(CATEGORY)

NEW MEXICO STATE UNIVERSITY
PHYSICAL SCIENCE LABORATORY
UNIVERSITY PARK, NEW MEXICO

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September 1963

Project Engineer

G. E. Johnson
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Approval:

Supervisor
Electromagnetics Section

H. W. Haas
Senior Engineer

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ABSTRACT

1965

The design and performance of a ground based three element helical antenna array for telemetering use in the frequency range from 225 μ /sec to 250 Mc/sec is reported. Radiation patterns and power contour plots are given for both right circular and linear polarizations. Impedance characteristics and construction details are also given.

Author

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1.0 INTRODUCTION

The Physical Science Laboratory of the New Mexico State University has been requested to design, fabricate, test and deliver one right circularly polarized array of helix antennas for the reception of telemetering signals in the frequency range from 225.0 Mc/sec to 250 Mc/sec.

1.1 Antenna Specifications

Antenna performance specifications based on the telemetering helical array for Vanguard Project designed at PSL were selected as follows.

1.1.1 Mechanical

The antenna shall withstand wind loadings associated with the environmental conditions of a hurricane.

The weight of the antenna shall be less than 300 pounds.

The antenna shall be fabricated from materials having optimum resistance to corrosion and weathering consistent with electrical requirements.

1.1.2 Electrical

Half-power beamwidth: $20^\circ \pm 3^\circ$ for the main lobe in horizontal and vertical planes.

Polarization: Right circular by IEEE definition.

Axial ratio: Less than 1.5:1 on the main lobe axis.

Directivity Gain: 19.5 ± 0.5 db

Operating Frequency Range: 225 - 250 Mc/sec

Input Impedance: 50 ohms nominal.

VSWR to 50 ohm line: Less than 1.5:1 over operating ranges.

Terminal Connector: Type N - Male

2.0 THE TRI-HELIX ARRAY DESIGN

2.1 Mechanical

To achieve maximum resistance to wind and corrosive atmosphere with minimum weight, the array was constructed of aluminum and protectively coated. Antenna masts are two-inch diameter aluminum tubing while the ground plane is an expanded aluminum mesh. All aluminum components in the ground plane and in the antenna helix coils are first anodized and later Iridite processed for corrosion resistance while the masts and mounting blocks are hard anodized to thicknesses varying from 0.002 inch to 0.004 inch. Junctions between dissimilar metals are avoided wherever possible. The unavoidable junction between the feeder connection and aluminum antenna element was silver plated at the feeder connector and the entire junction insulated from atmospheric environment by painting. In addition, aluminum connectors employed should be wrapped and painted. Corrosive resistant hardware, such as stainless steel and cadmium plated steel is used throughout. Guyed antenna masts and high wind resistance are avoided by using aluminum tubing for antenna masts and expanded aluminum mesh for ground screen material. The entire array is spray-painted, using Plasite No. 7133 (with a cyanamide blue dye added to reduce glare) manufactured by Wisconsin Protective Products Company, Green Bay, Wisconsin. The titanium dioxide pigmented paint was specially selected and tested for its low rf loss characteristics and corrosion protective qualities.

2.2 Electrical

2.2.1 Radiation Pattern

The desired directivity and power gain may be achieved using an array of three elements, each consisting of eight turns each approximately 0.344λ in diameter and each turn spaced approximately 0.25λ from adjacent turns. The resulting directivity should be approximately 19.5 db above isotropic.

2.2.2 Impedance Transformation

The terminal impedance of each of the helix radiators is approximately 150 ohms over the designed operating range of frequencies.

Each impedance is transformed, using an integral quarter wave transmission line transformer, to a nominal 50 ohms at the center frequency. The three antennas are connected to a four port transmission line element consisting of a three-output power divider by means of low loss transmission lines and re-transformed within the power divider to 50 ohms at its input. The array is thus designed to be operated within a 50-ohm system from that point on.

The three-output power divider was supplied on special order as a D2-A97 output power divider by Microlab, Inc., 570 West Mount Pleasant Avenue, Livingston, New Jersey; the low loss transmission line is one-half inch diameter, 50 ohm Foamflex manufactured by Phelps-Dodge.

Foamflex connectors were manufactured by Communication Products Company and are Quick-Tite, Type N, male connectors, Number 22-654.

3.0 TRI-HELIX MEASUREMENTS

3.1 Mechanical

Photographs of antenna component parts, consisting of helix elements, assembled ground plane, feeder transmission lines and power divider are given in Figures 1-5.

3.2 Electrical

3.2.1 Radiation Patterns

The array was taken to the PSZ antenna range, installed for radiation pattern measurement as shown in Figures 6 and 7, and radiation patterns measured using both right circular and linear polarizations. Coordinates used for radiation pattern measurements are shown in Figure 8, per IRIG Antenna Pattern Document Number 102-6; the resulting radiation patterns measured at 237.5 Mc/sec and at 250.0 Mc/sec are shown in Figures 9-64. Constant power contours measured at 237.5 Mc/sec for right circular and linear polarizations are given in Figures 65-67.

3.2.2 Impedance

Impedance measurements taken at the power divider input, at the three transmission line inputs and at the antenna transformer inputs are given in Figures 68-74. The impedance variation at the terminated power divider is given in Figure 75.

4.0 SUMMARY

4.1 Construction

The Tri-Helix Array has been constructed to survive 100 mph winds and has been plated and painted with materials selected for maximum resistance to corrosion.

4.2 Radiation Pattern

The Tri-Helix Array radiates a right circularly polarized wave exhibiting approximately 19.5 db directivity gain and approximately 15.9 db \pm 0.25 db power gain with respect to an isotropic radiator. The power gain with respect to a dipole reference is thus 16.75 db \pm 0.25 db in a right circular illuminating field and 10.75 db \pm 0.25 db in a linear illuminating field. Radiation pattern stability with frequency change is quite good.

4.3 Impedance

The input impedance of the array is within a 1.5:1 VSWR contour to a 50-ohm system over the operating frequency range (see Figure 68).



FIG. 1 - GROUND PLANE - ASSEMBLED



FIG. 2 - HELIX ANTENNA COILS



FIG. 3 - COAXIAL TRANSMISSION LINES, POWER DIVIDER

FIG. 4 - ANTENNA TRANSFORMER IN PLACE





FIG. 5 - ANTENNA MOUNTING BLOCK AND FEED CONNECTOR

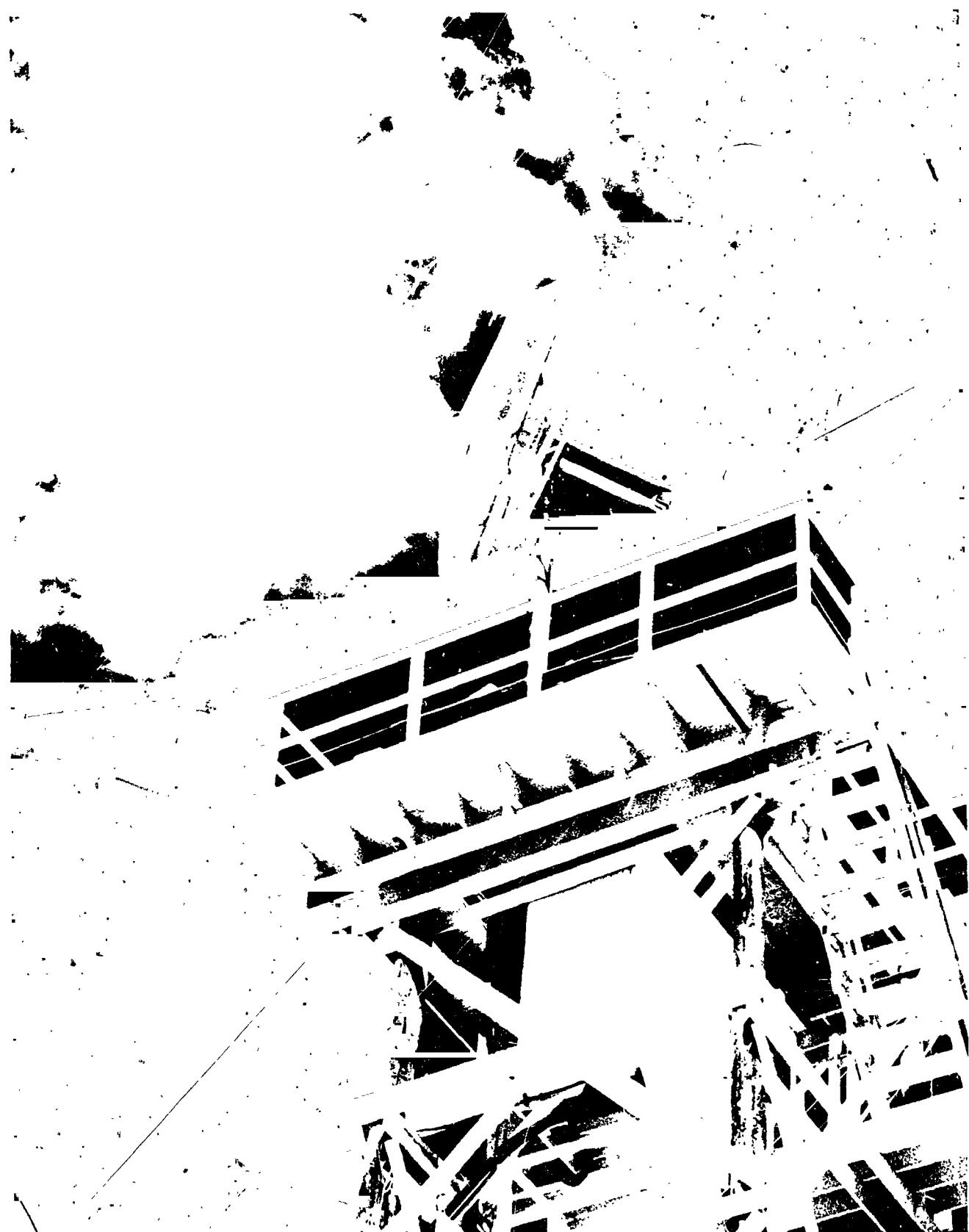


FIG. 6 - TRI-HELIX ARRAY IN POSITION FOR RADIATION
PATTERN MEASUREMENTS

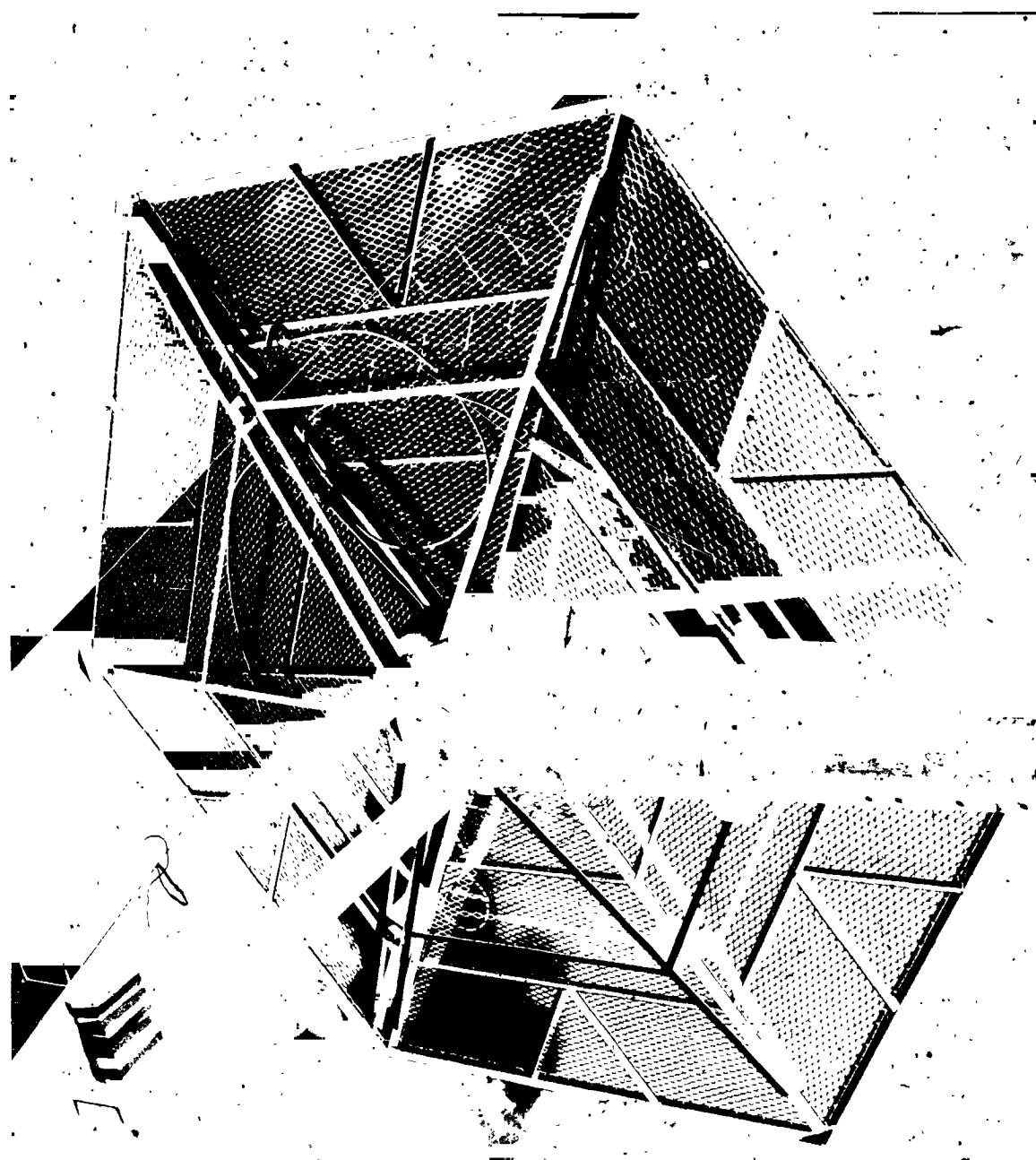


FIG. 7 - COAXIAL CABLE LAYOUT ON TRI-HELIX ARRAY DURING
RADIATION PATTERN MEASUREMENTS

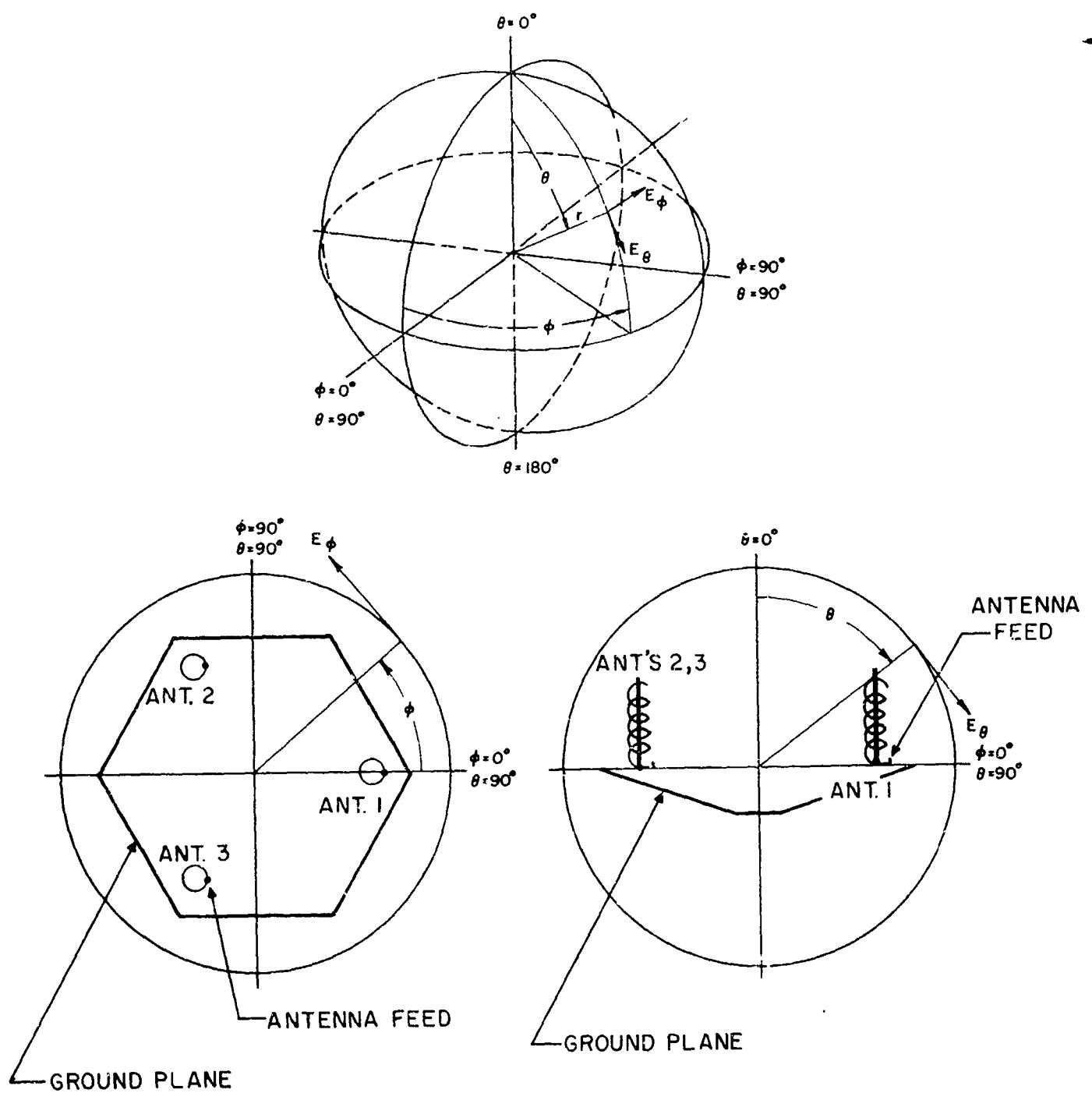


FIG. 8 - COORDINATES USED FOR TRI-HELIX RADIATION PATTERN MEASUREMENTS

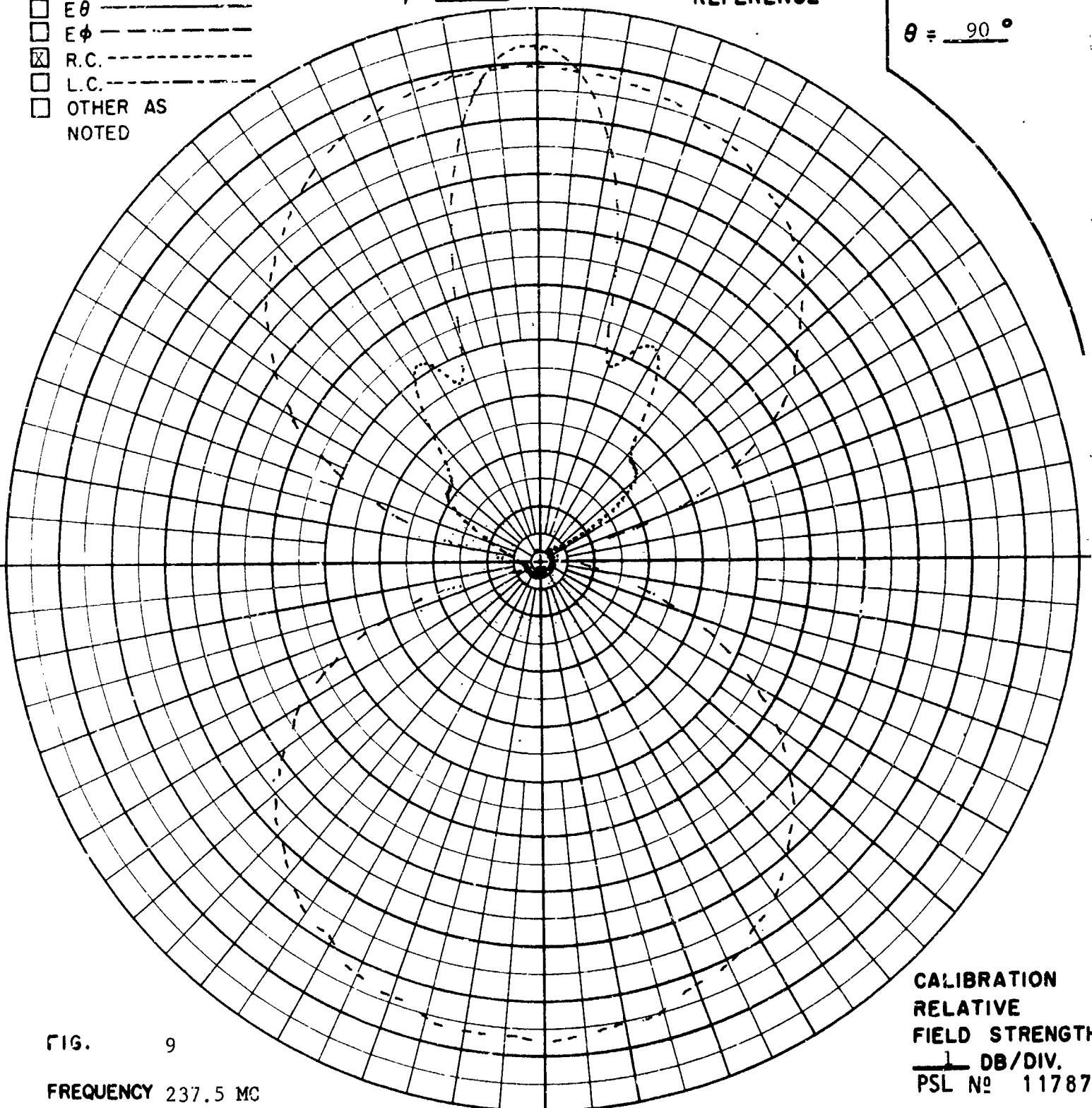
POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °
 $\theta = \underline{\hspace{1cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
1 DB/DIV.
PSL N° 11787

FIG. 9

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS TRI - HELIX GAIN AT $\phi = 0^\circ$, $\theta = 0^\circ$ IS 16.5 DB OVER REFERENCE DIPOLE.
TRI - HELIX (R. C.) HAS 16.0 DB ATTENUATION ADDED TO TRANSMISSION LINE.

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS
NCTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °

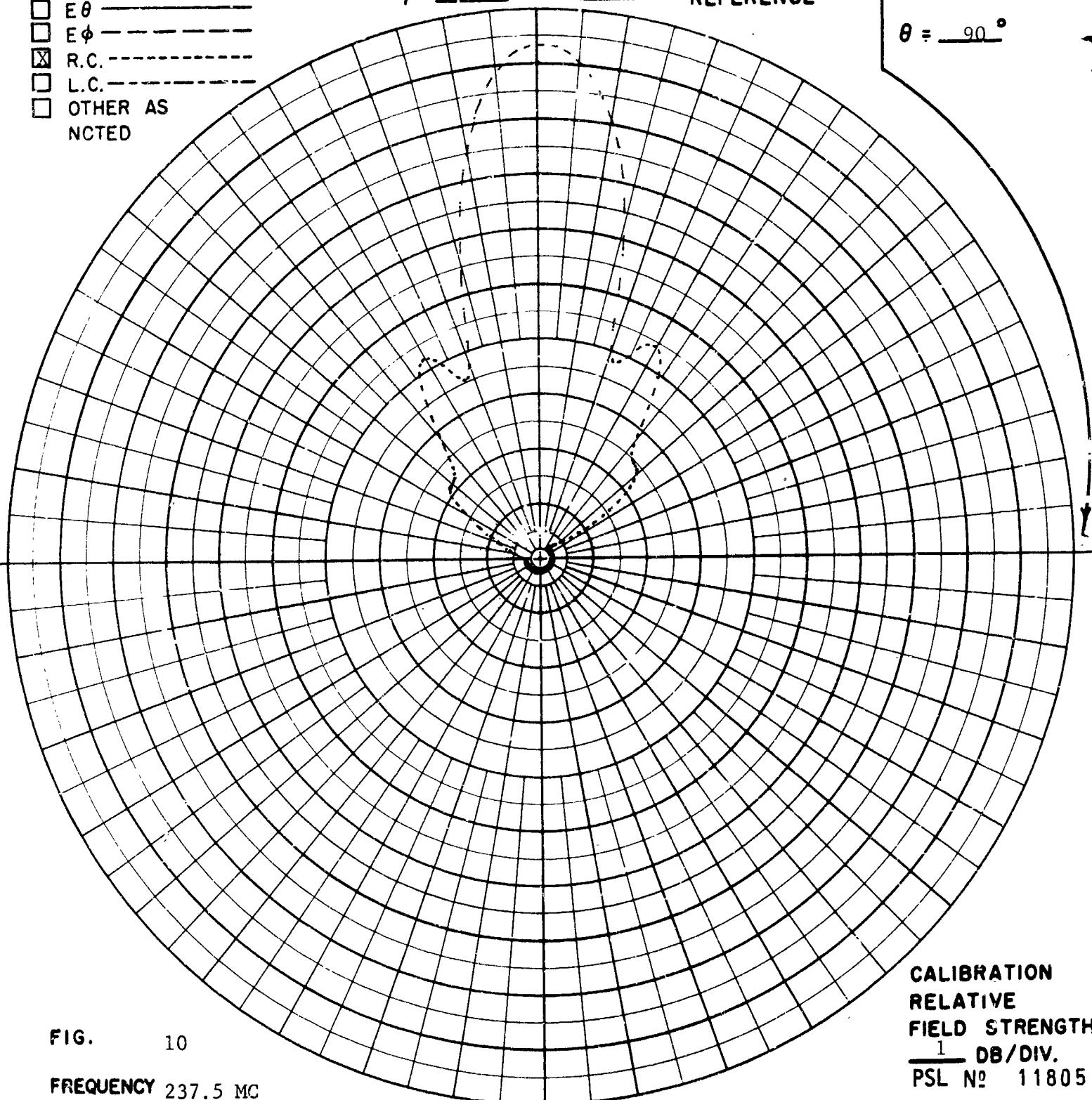


FIG. 10

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11805

15

POLARIZATION

- GAIN REF - - - -
- E θ - - - -
- E ϕ - - - -
- R.C. - - - -
- L.C. - - - -
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}^{\circ}$ $\theta = \underline{\hspace{1cm}}^{\circ}$ COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}^{\circ}$
 $\theta = \underline{\hspace{1cm}}^{\circ}$

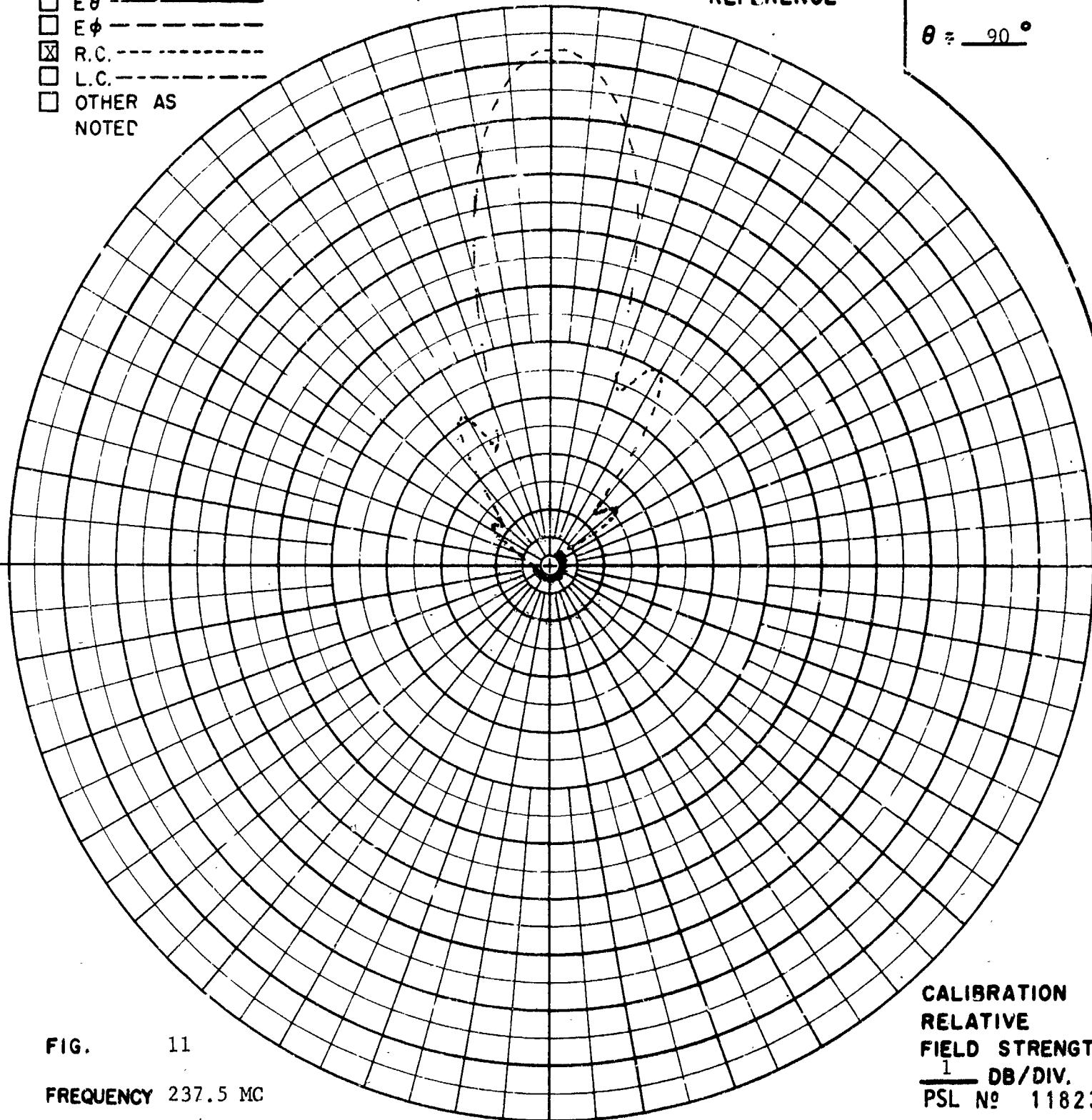


FIG. 11

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11823

POLARIZATION

- GAIN REF -----
 E θ -----
 E ϕ -----
 R.C. -----
 L.C. -----
 OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ 20 °
 $\theta = \underline{\hspace{1cm}}$ 90 °

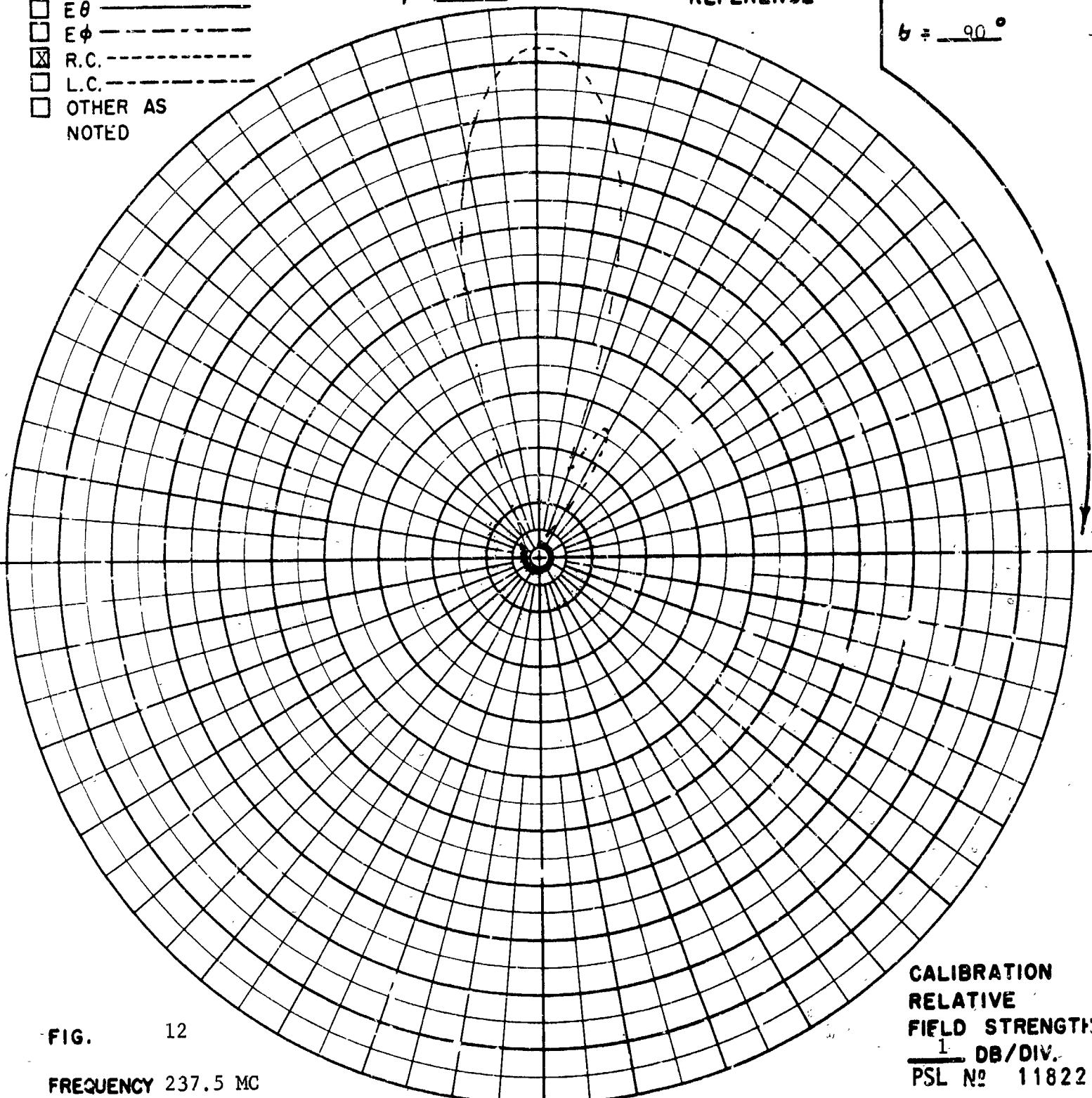


FIG. 12

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL NO 11822

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ 30 °

$\theta = \underline{\hspace{2cm}}$ 90 °

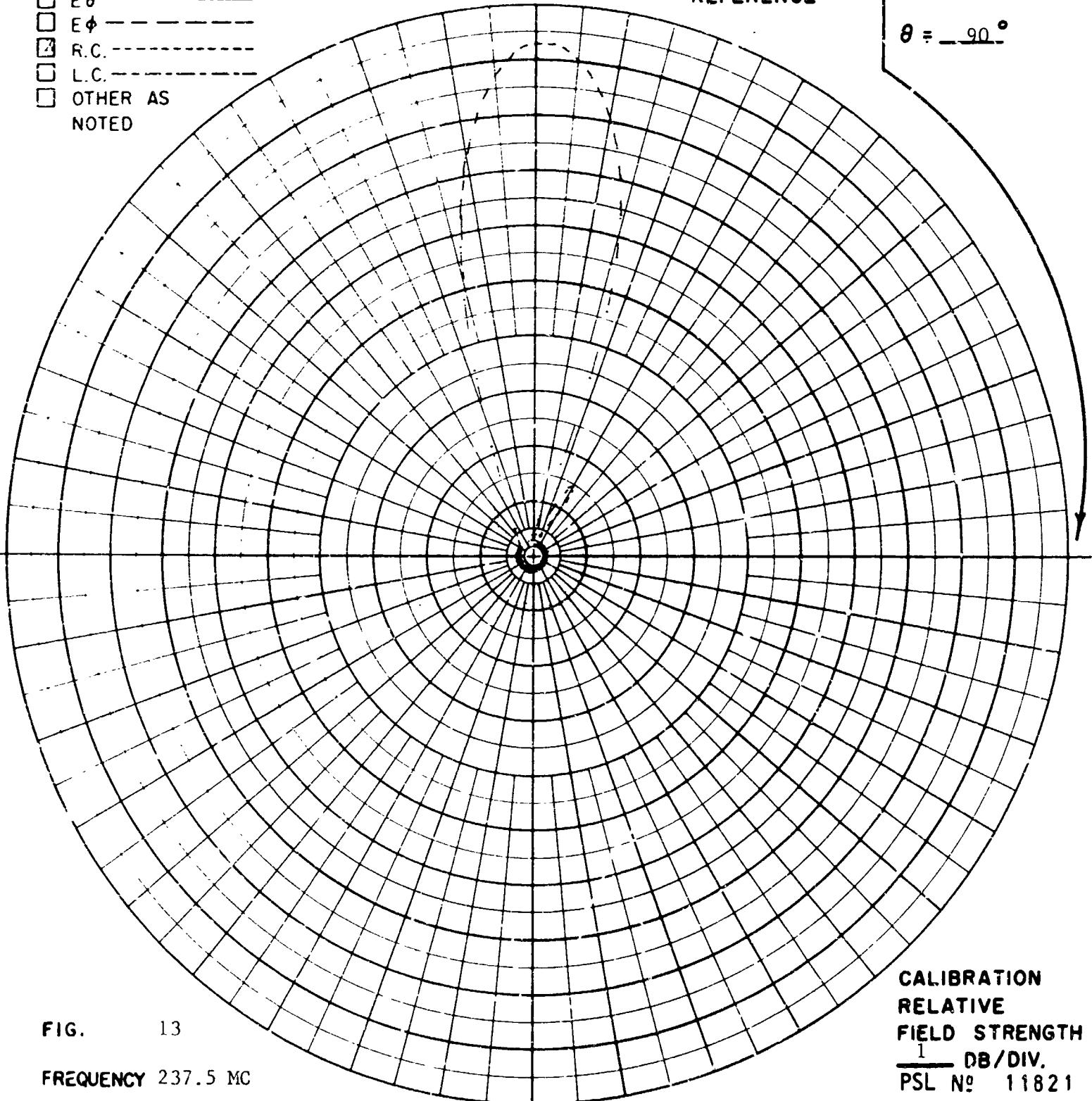


FIG. 13

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ 40 °
 $\theta = \underline{\hspace{2cm}}$ 90 °

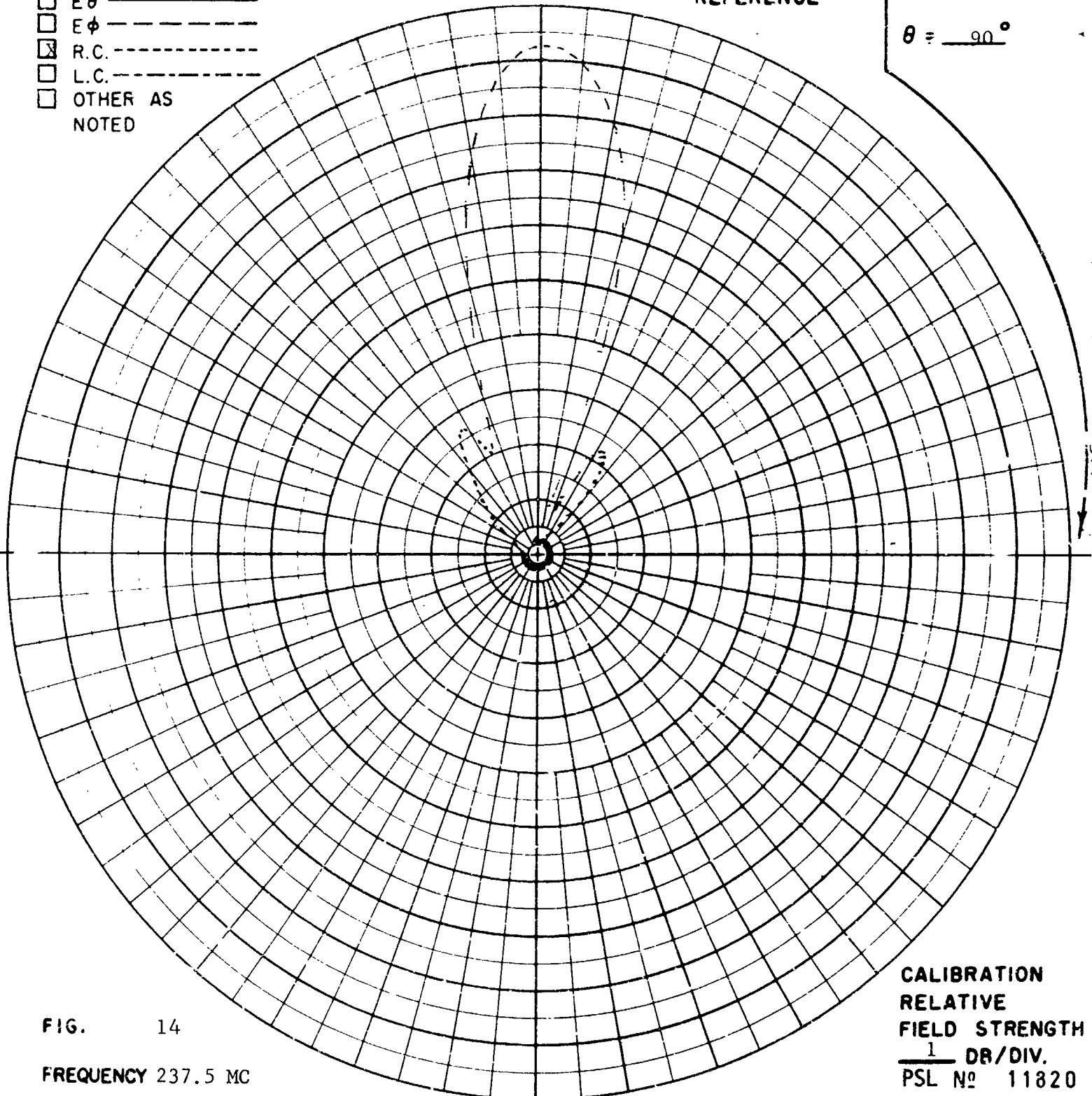


FIG. 14

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DR/DIV.}}$
PSL № 11820

POLARIZATION

- GAIN REF -----
 E θ -----
 E ϕ -----
 R.C. -----
 L.C. -----
 OTHER AS
NOTED

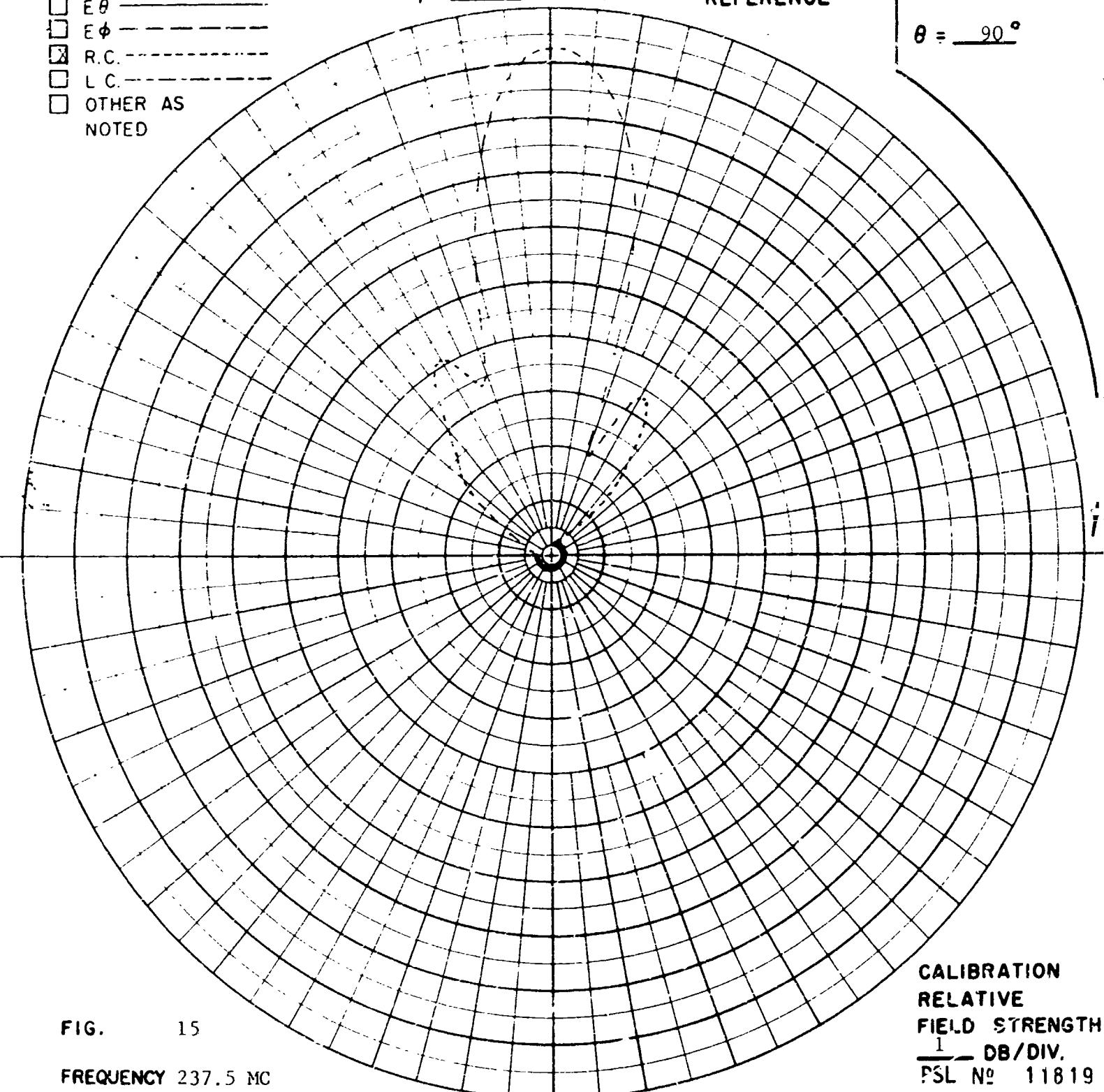
 $\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °COORDINATE
REFERENCE $\phi = \underline{\hspace{1cm}}$ 50 °
 $\theta = \underline{\hspace{1cm}}$ 90 °

FIG. 15

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11819

POLARIZATION

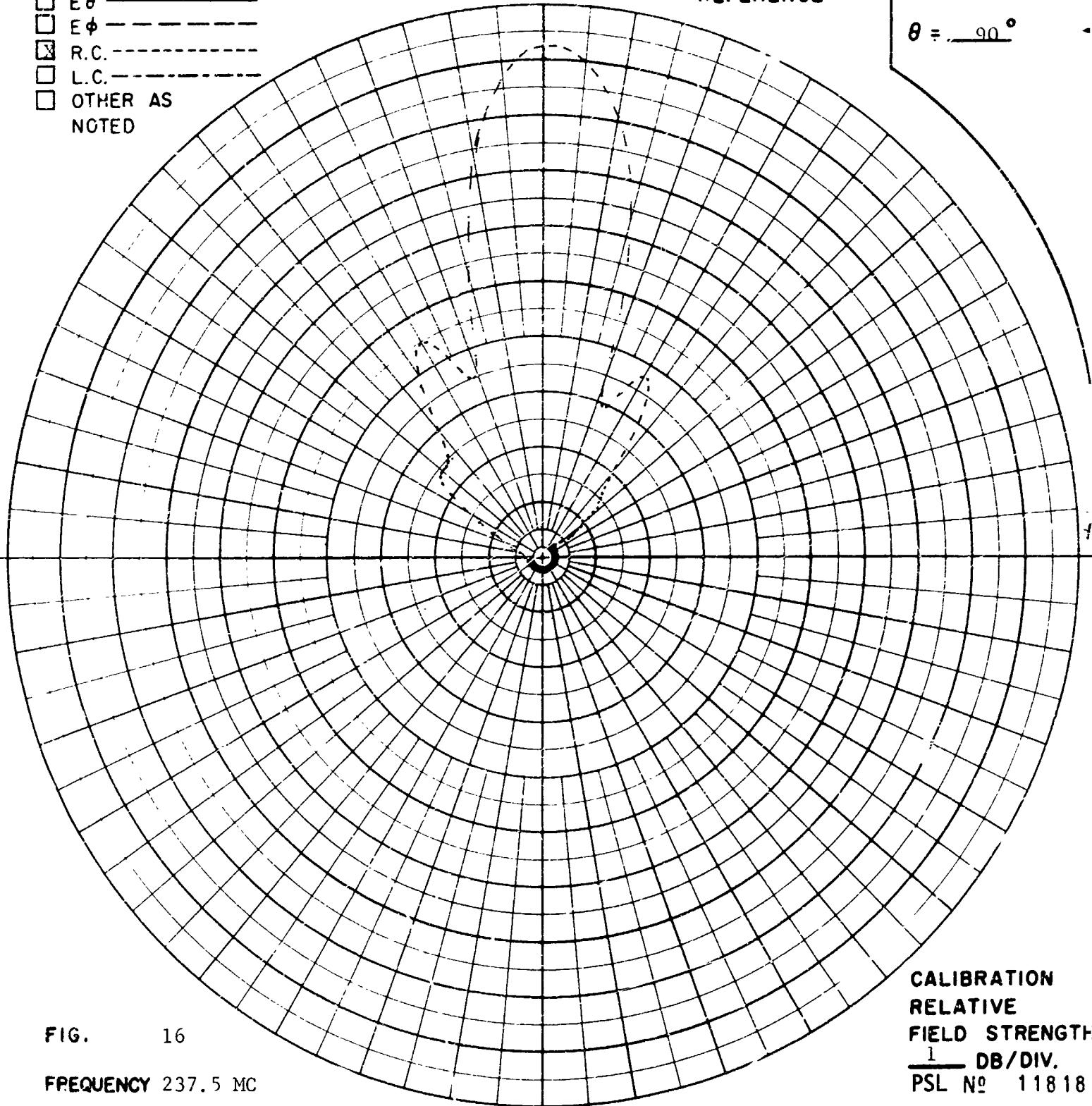
- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °

$\theta = \underline{\hspace{2cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11818

FIG. 16

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ 70 °
 $\theta = \underline{\hspace{2cm}}$ 90 °

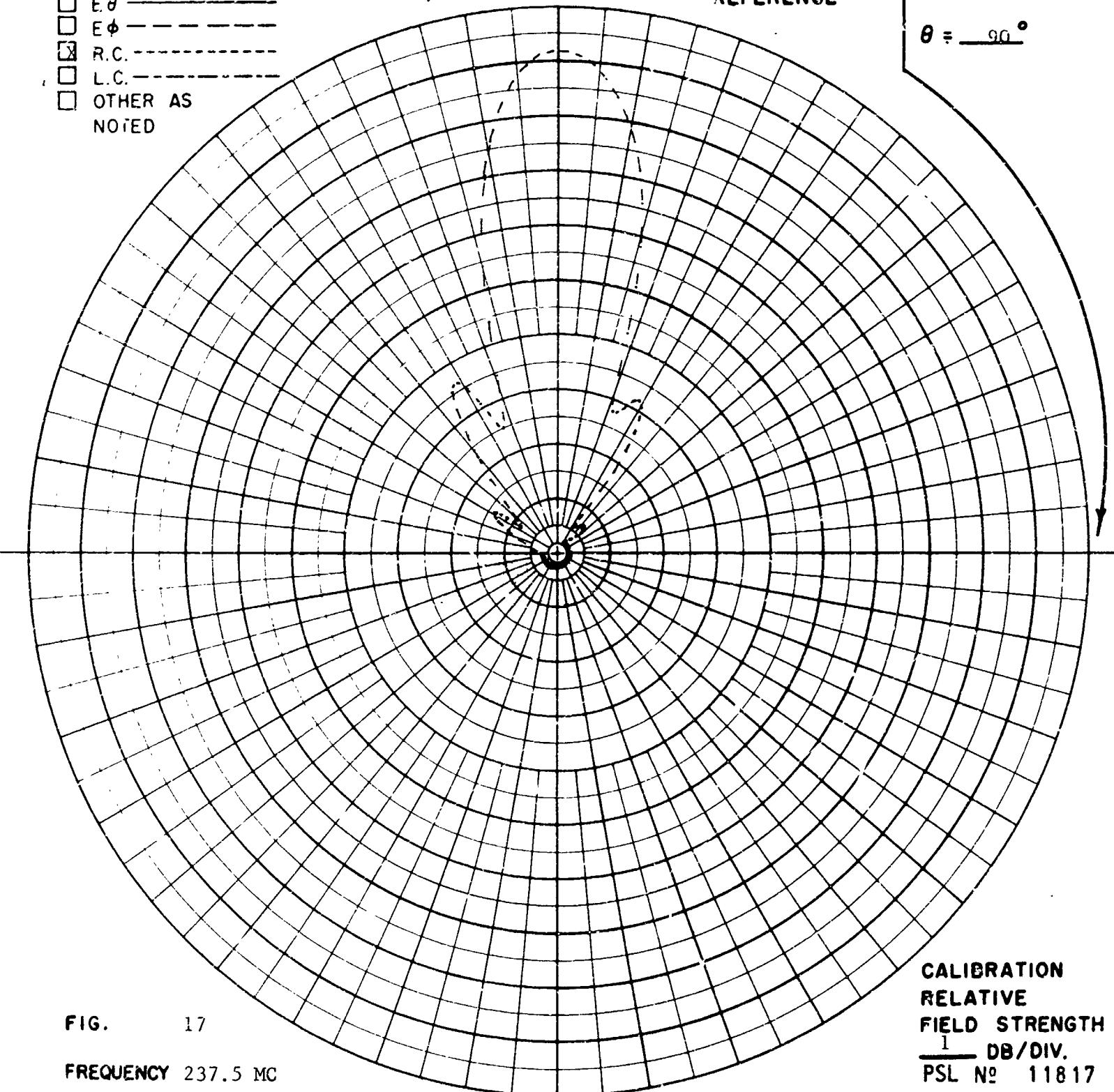


FIG. 17

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11817

POLARIZATION

- GAIN REF -----
- E_R -----
- E_Φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}^{\circ}$
 $\theta = \underline{\hspace{2cm}}^{\circ}$

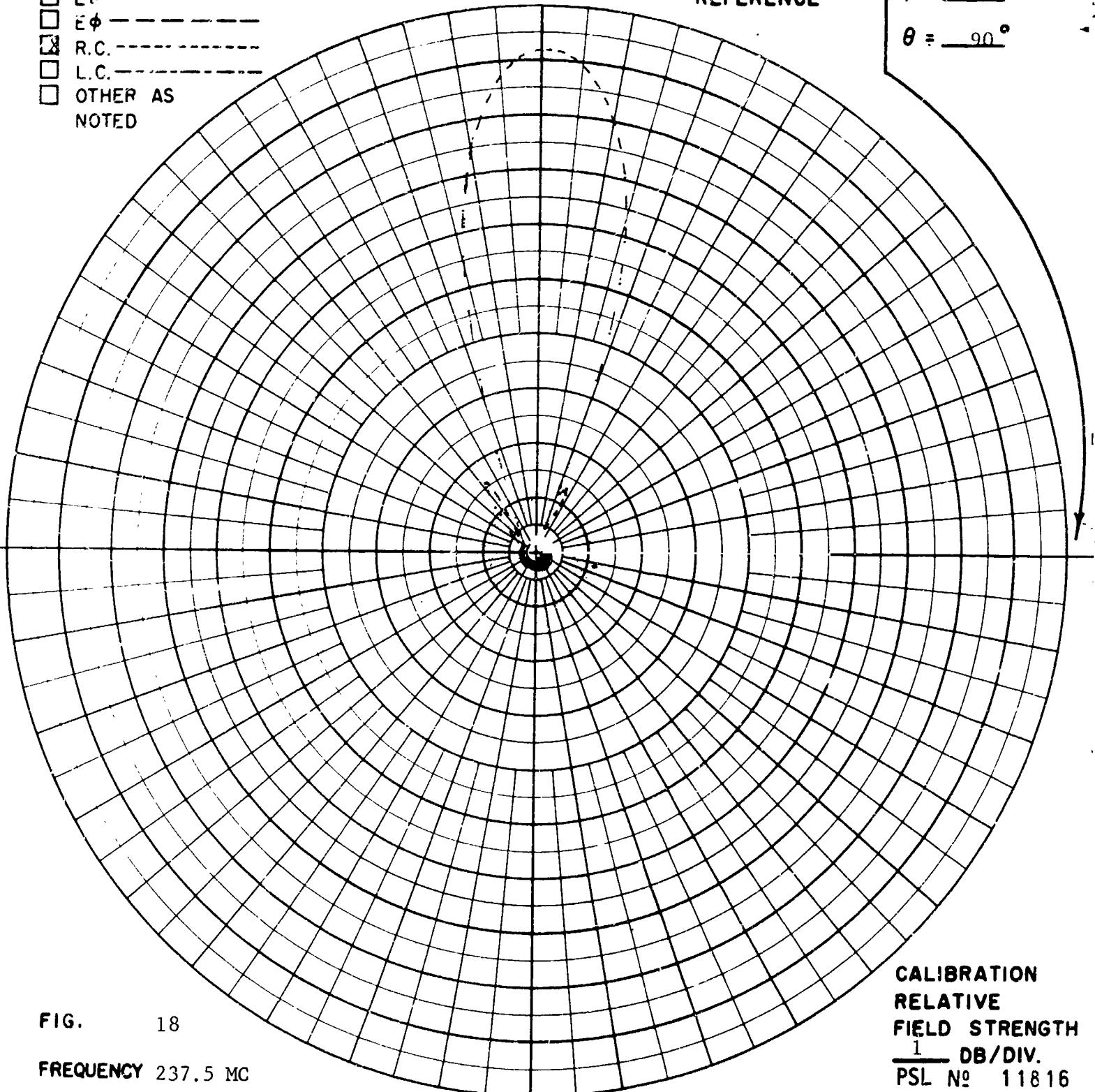


FIG. 18

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL № 11816

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ 90 °

$\theta = \underline{\hspace{1cm}}$ 90 °

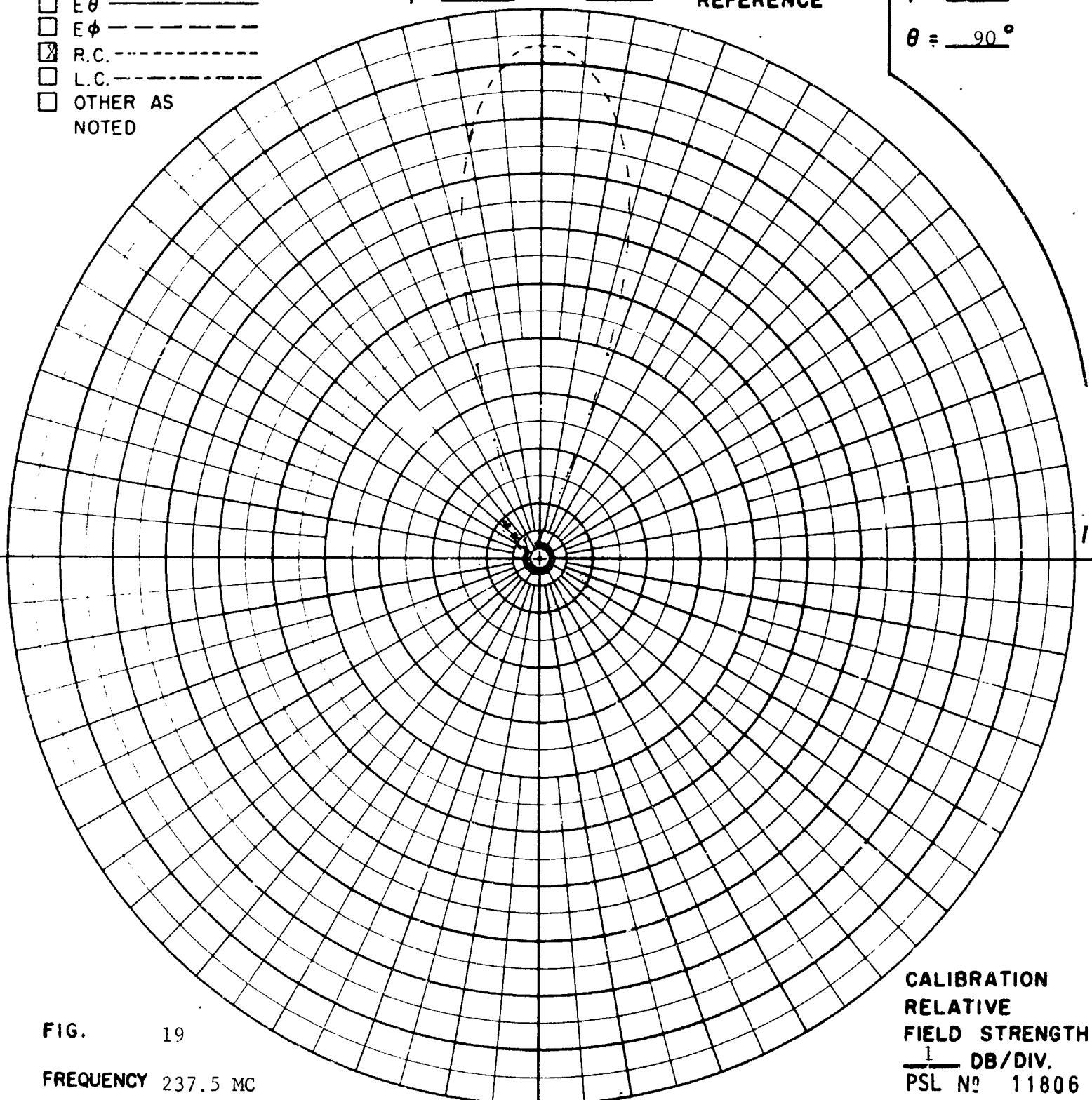


FIG. 19

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11806

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ 100 °
 $\theta = \underline{\hspace{2cm}}$ 90 °

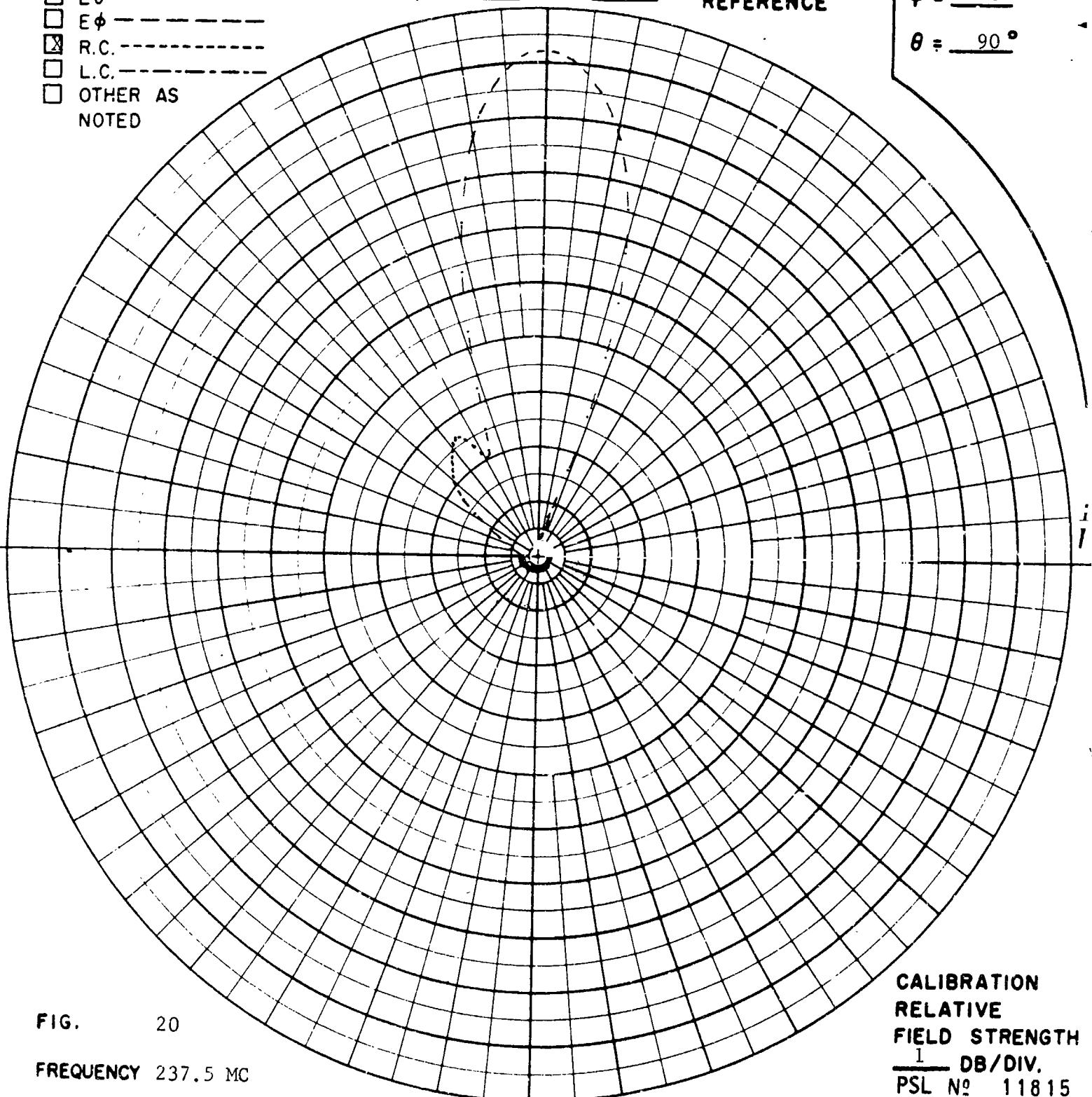


FIG. 20

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11815

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}} 110$ °
 $\theta = \underline{\hspace{1cm}} 90$ °

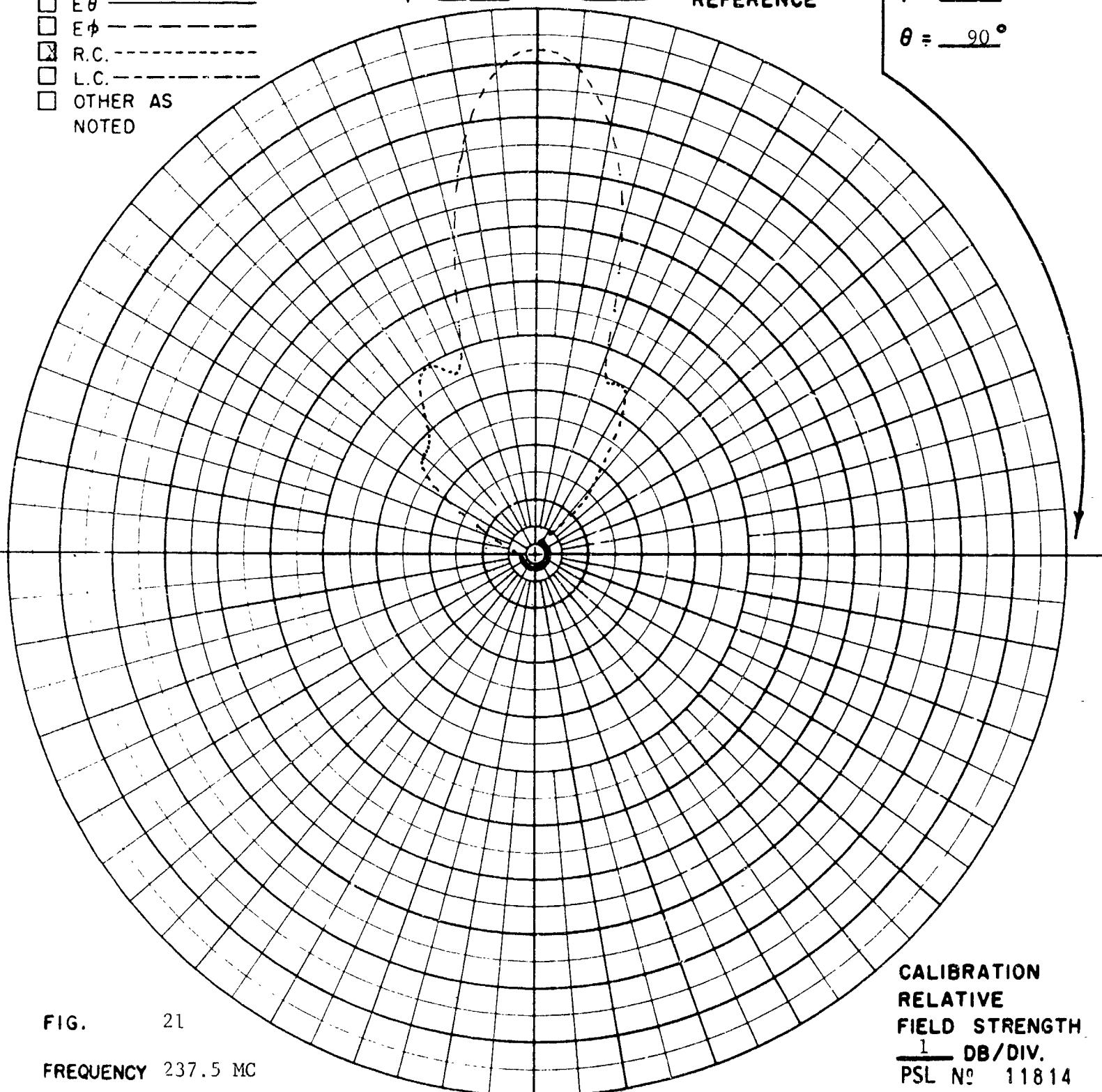


FIG.

21

FREQUENCY 237.5 MC

ANTENNA TRT - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11814

POLARIZATION

- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °
 $\theta = \underline{\hspace{1cm}}$ °

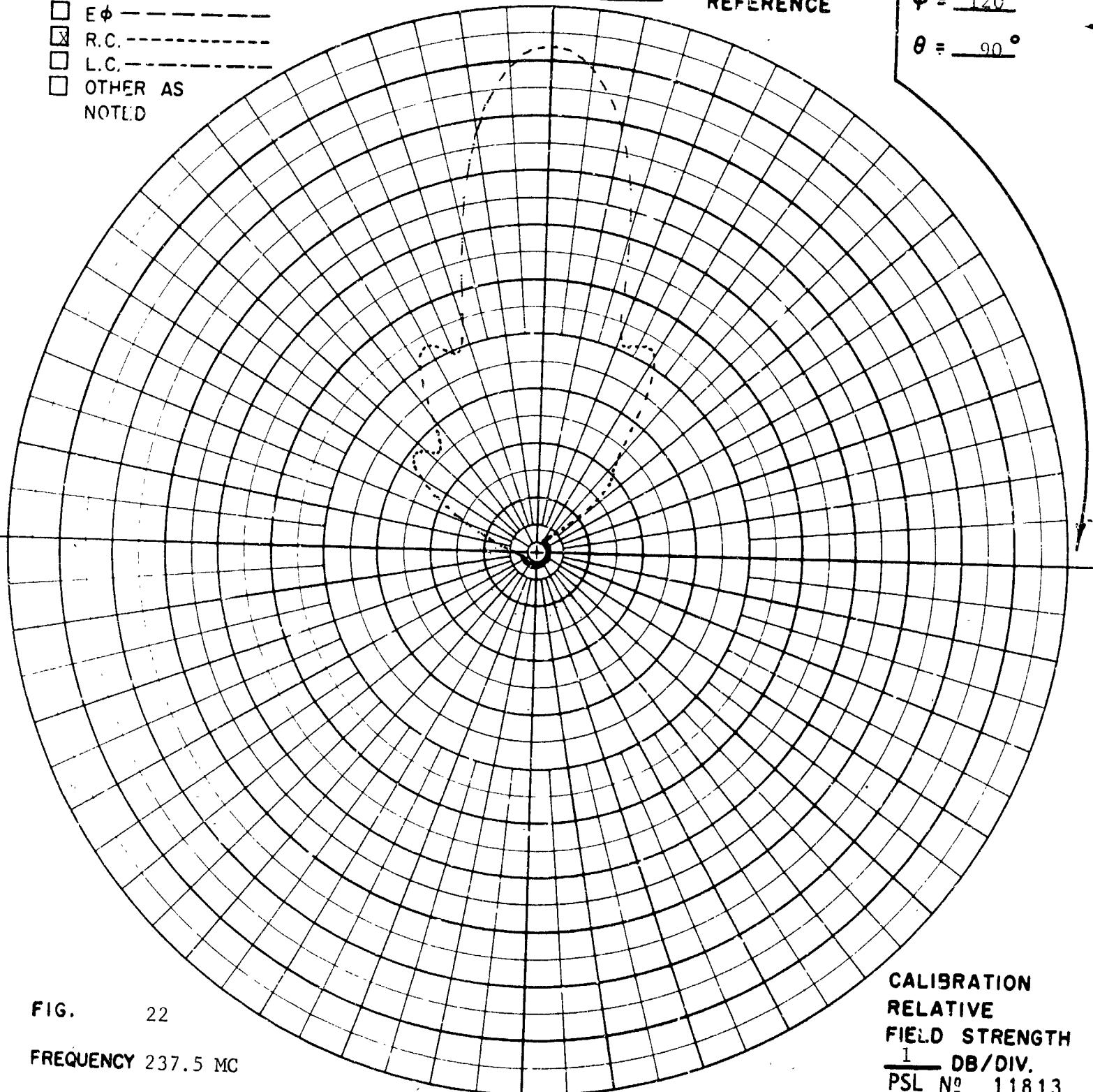


FIG. 22

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11813

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$ COORDINATE REFERENCE

$\phi = \underline{\hspace{2cm}}^{\circ}$
 $\theta = \underline{\hspace{2cm}}^{\circ}$

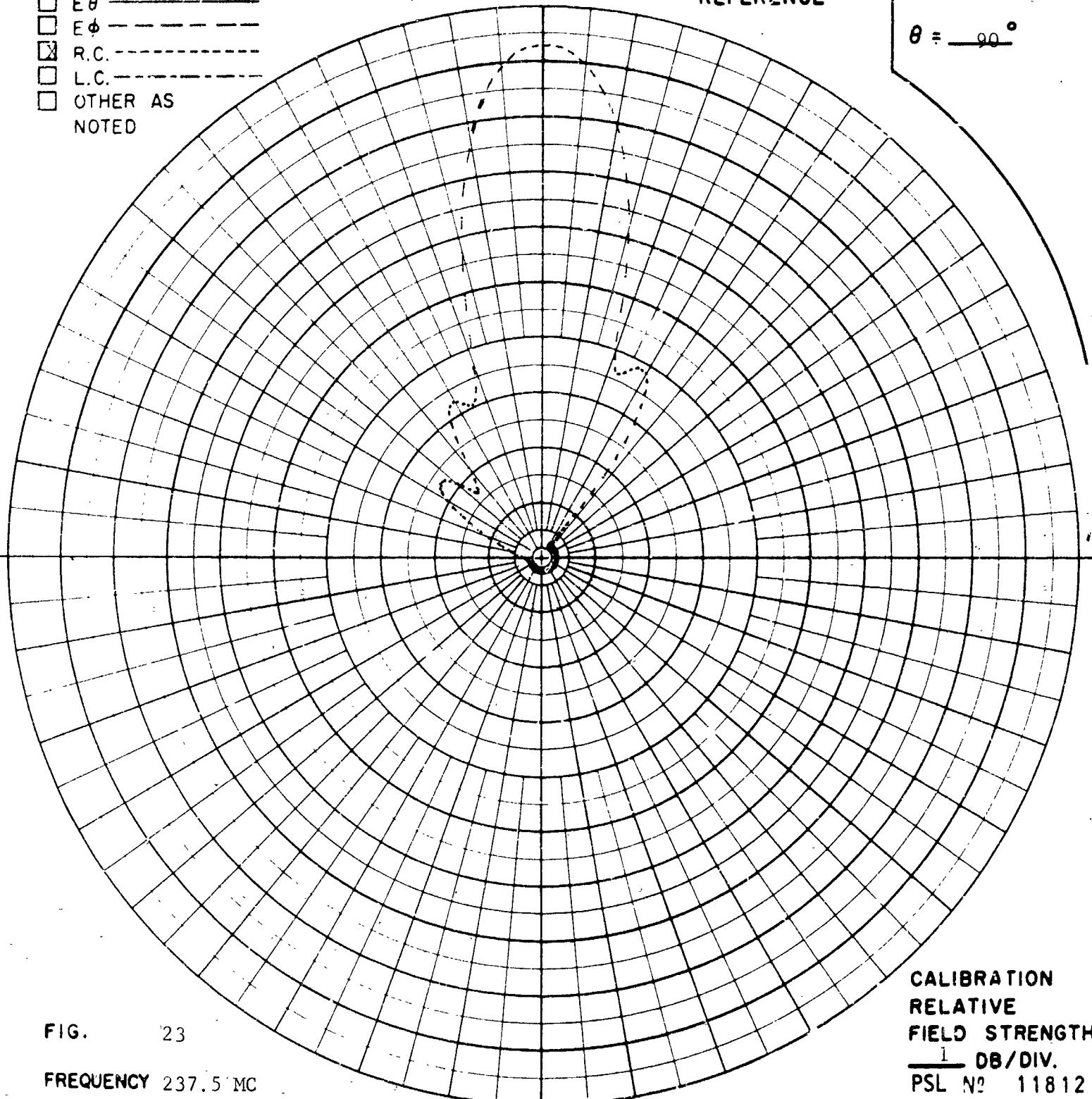


FIG. 23

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11812

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °

$\theta = \underline{\hspace{1cm}}$ °

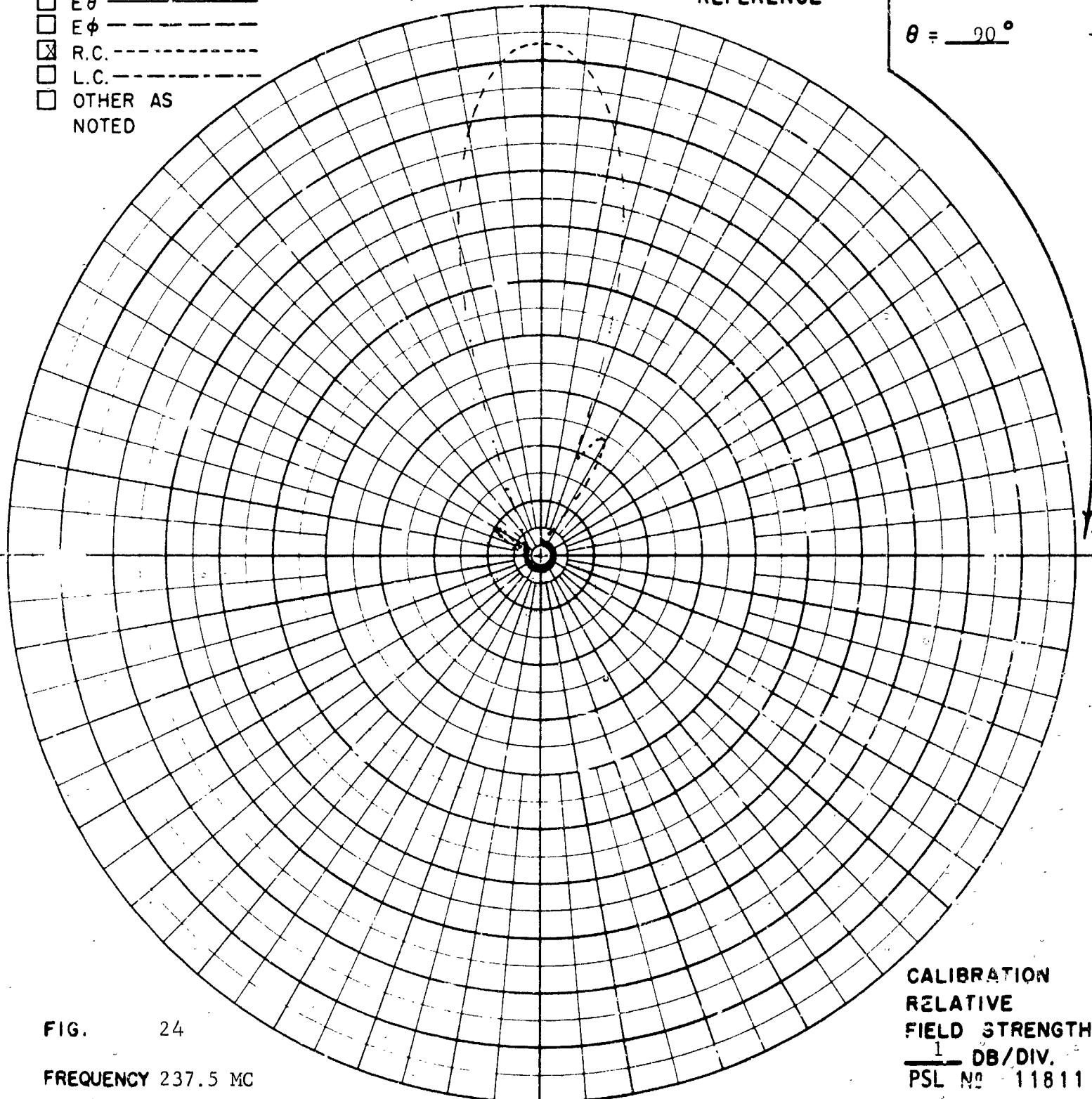


FIG. 24

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL NO 11811

POLAR ZAT DN

- GAIN REF -----
 E θ -----
 E ϕ -----
 R θ -----
 L.C. -----
 OTHER AS
NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °
 $\theta = \underline{\hspace{1cm}}$ °

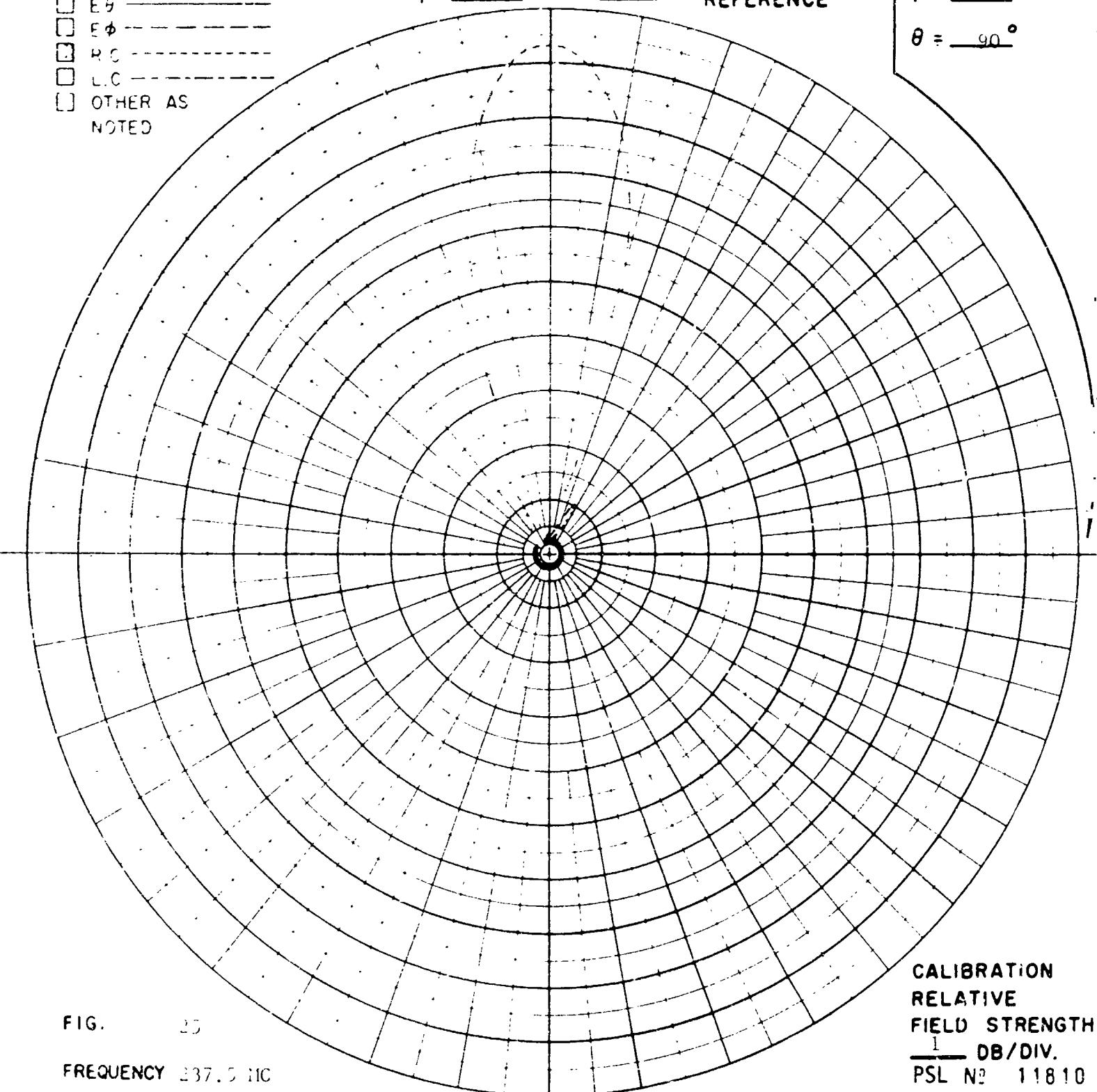


FIG.

25

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N^o 11810

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °

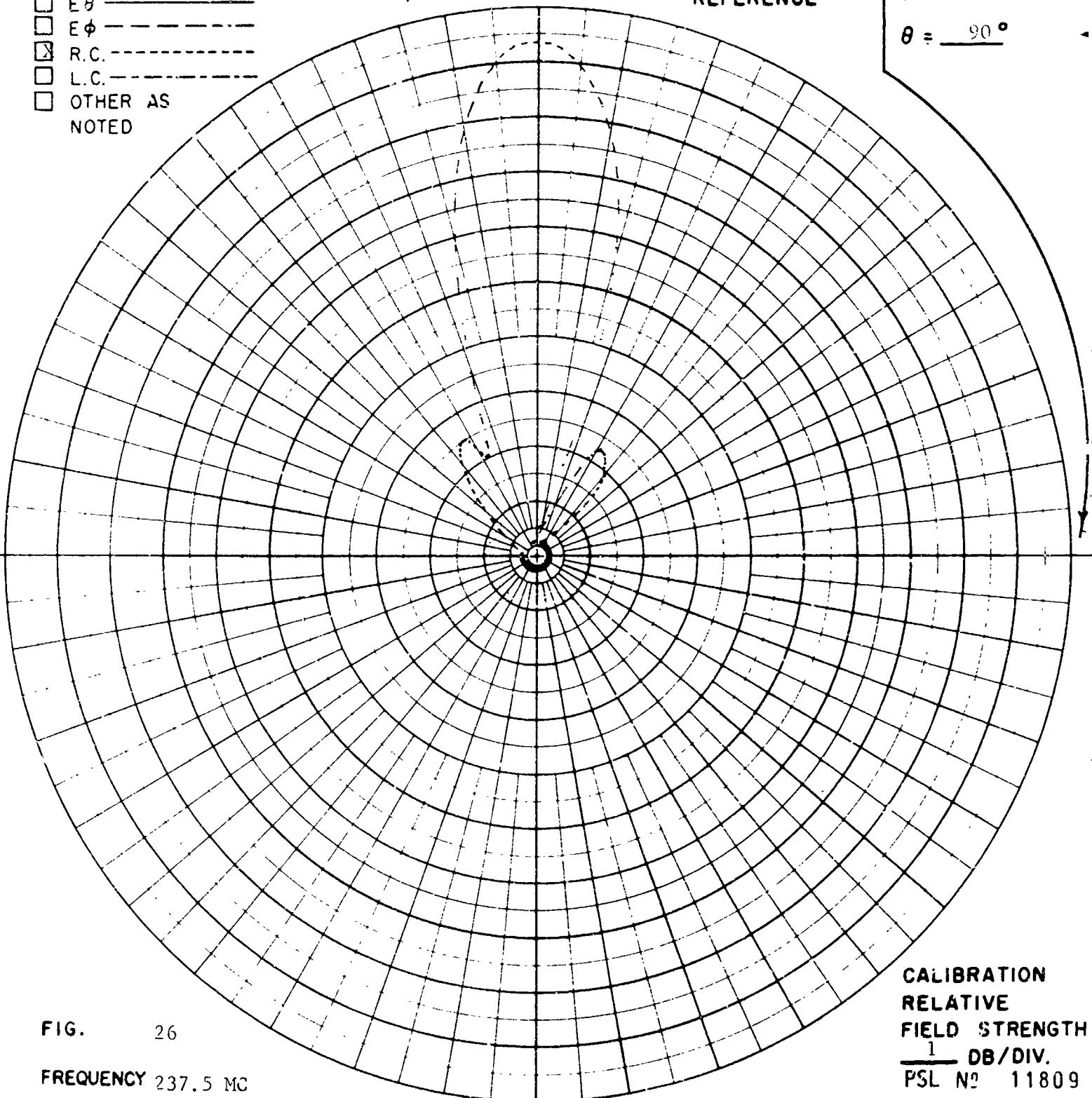


FIG. 26

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11809

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{170}$ °
 $\theta = \underline{90}$ °

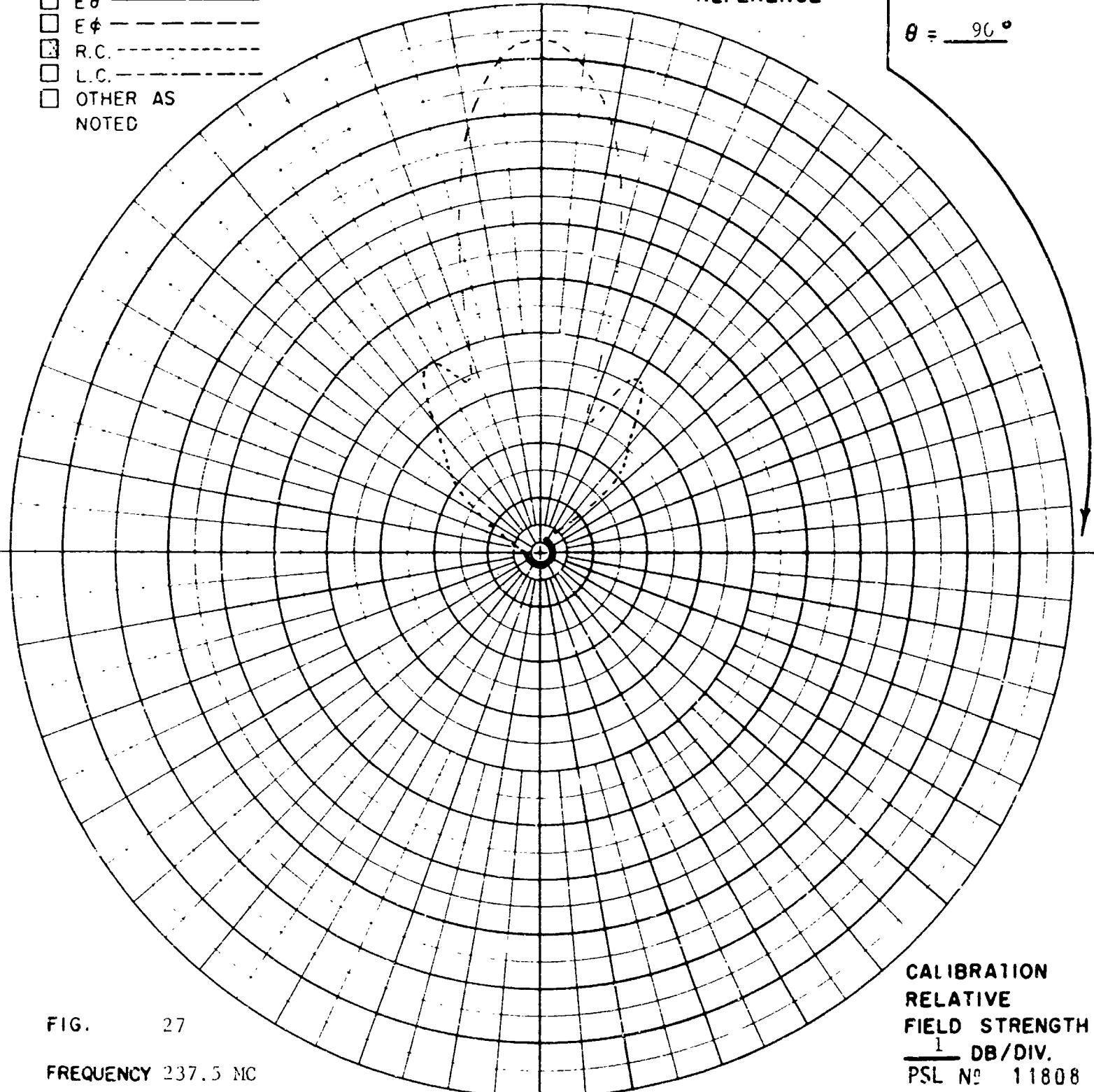


FIG. 27

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

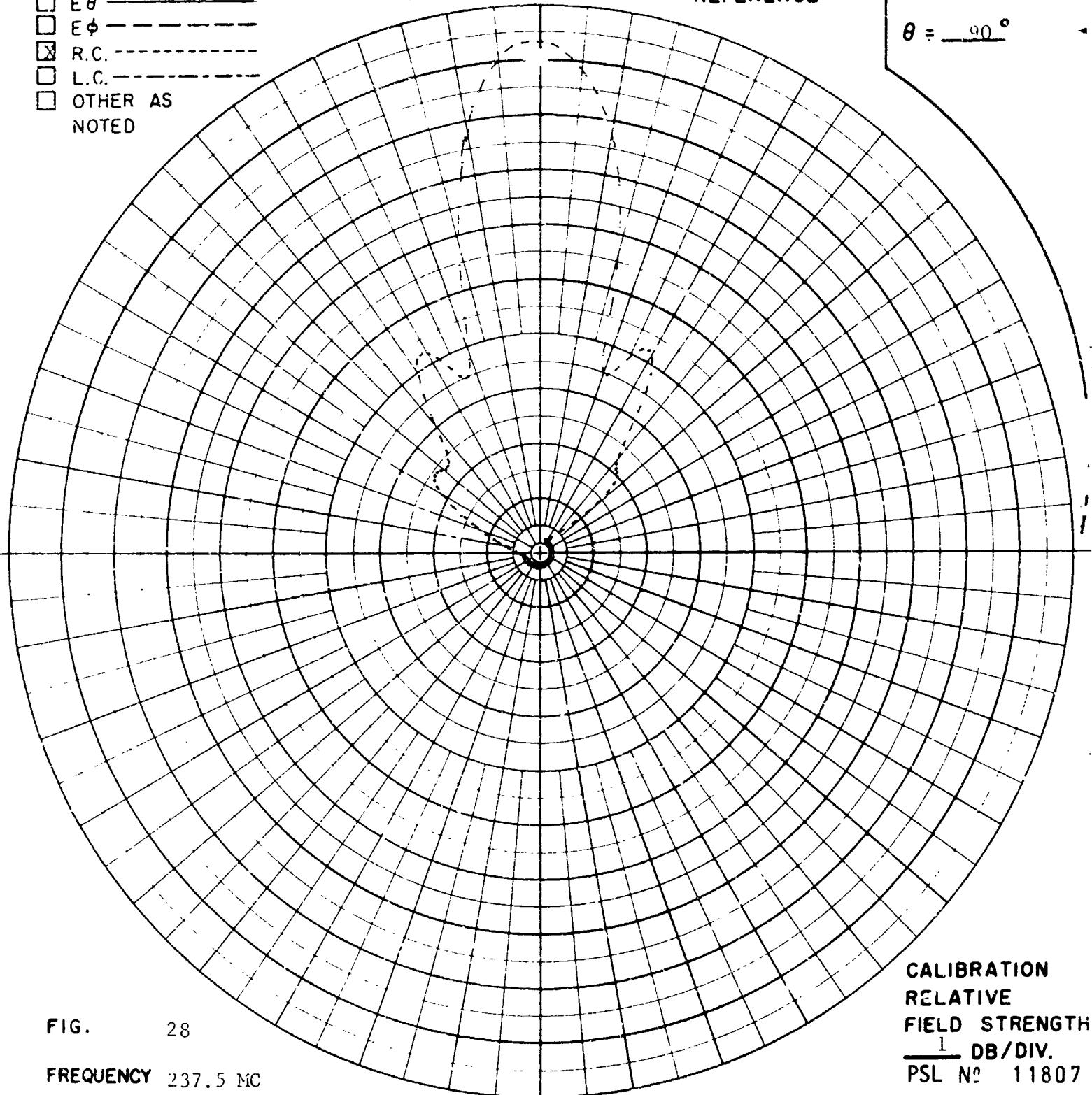
POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11807

FIG. 28

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

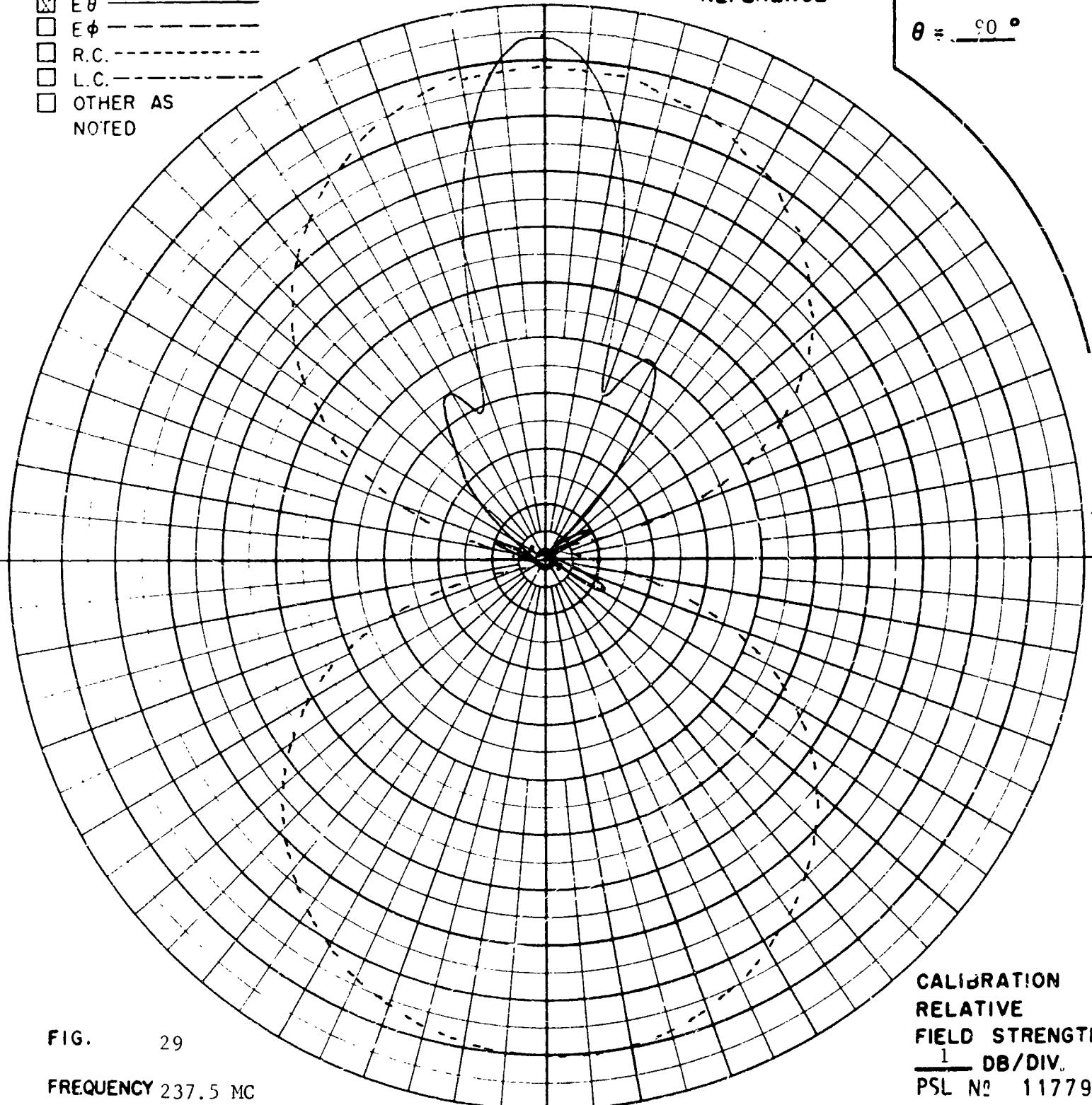
- GAIN REF -----
 E_θ -----
 E_φ -----
 R.C. -----
 L.C. -----
 OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °

$\theta = \underline{\hspace{1cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11779

FIG. 29

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS TRI - HELIX GAIN AT $\phi = 0^\circ$, $\theta = 0^\circ$ IS 11.0 DB ABOVE REFERENCE DIPOLI.
TRI - HELIX (E_θ) HAS 10.0 DB ATTENUATION ADDED TO TRANSMISSION LINE.

POLARIZATION

- GAIN REF -----
- E_θ _____
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ 0 °
 $\theta = \underline{\hspace{1cm}}$ 90 °

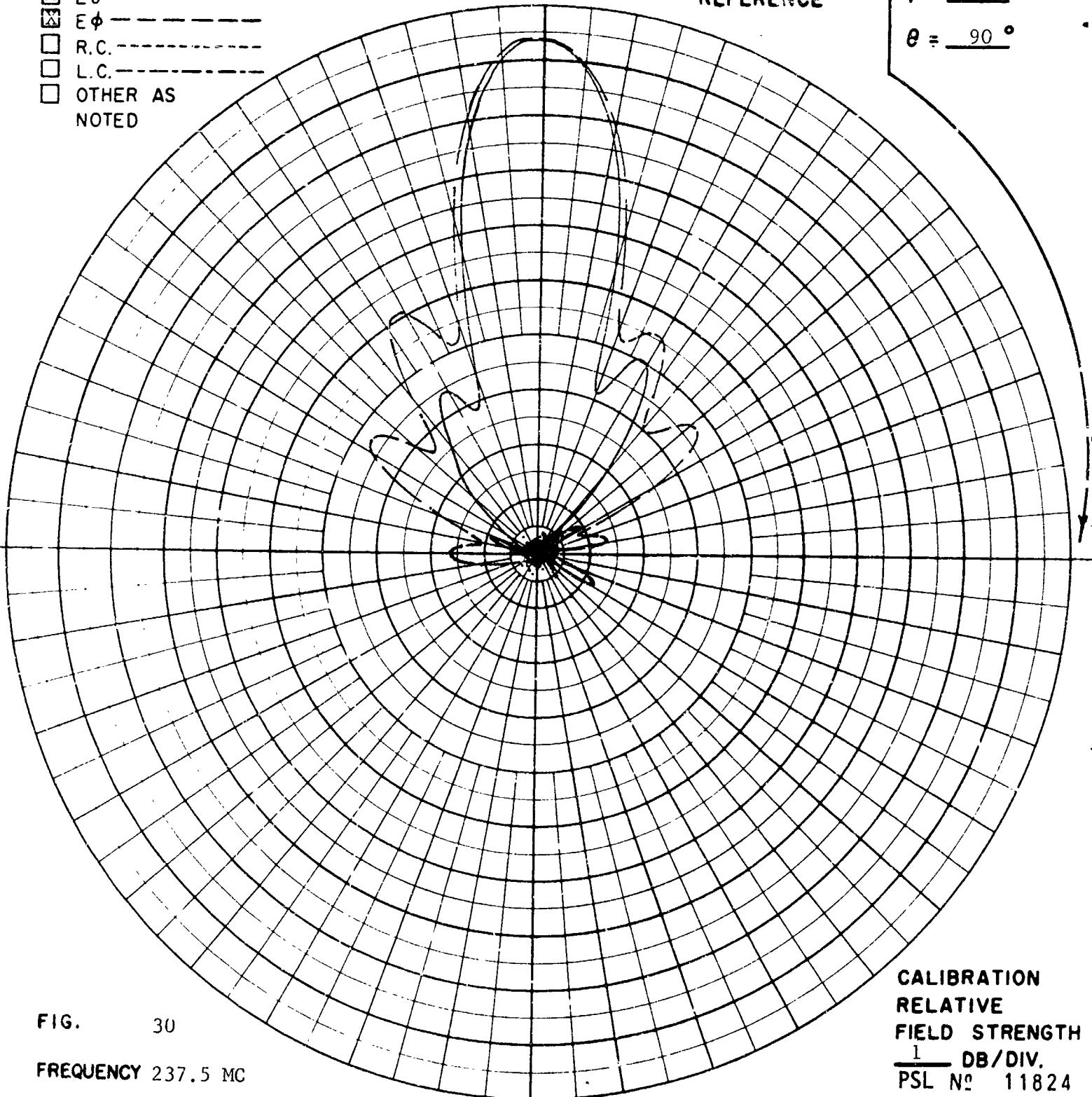


FIG. 30

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

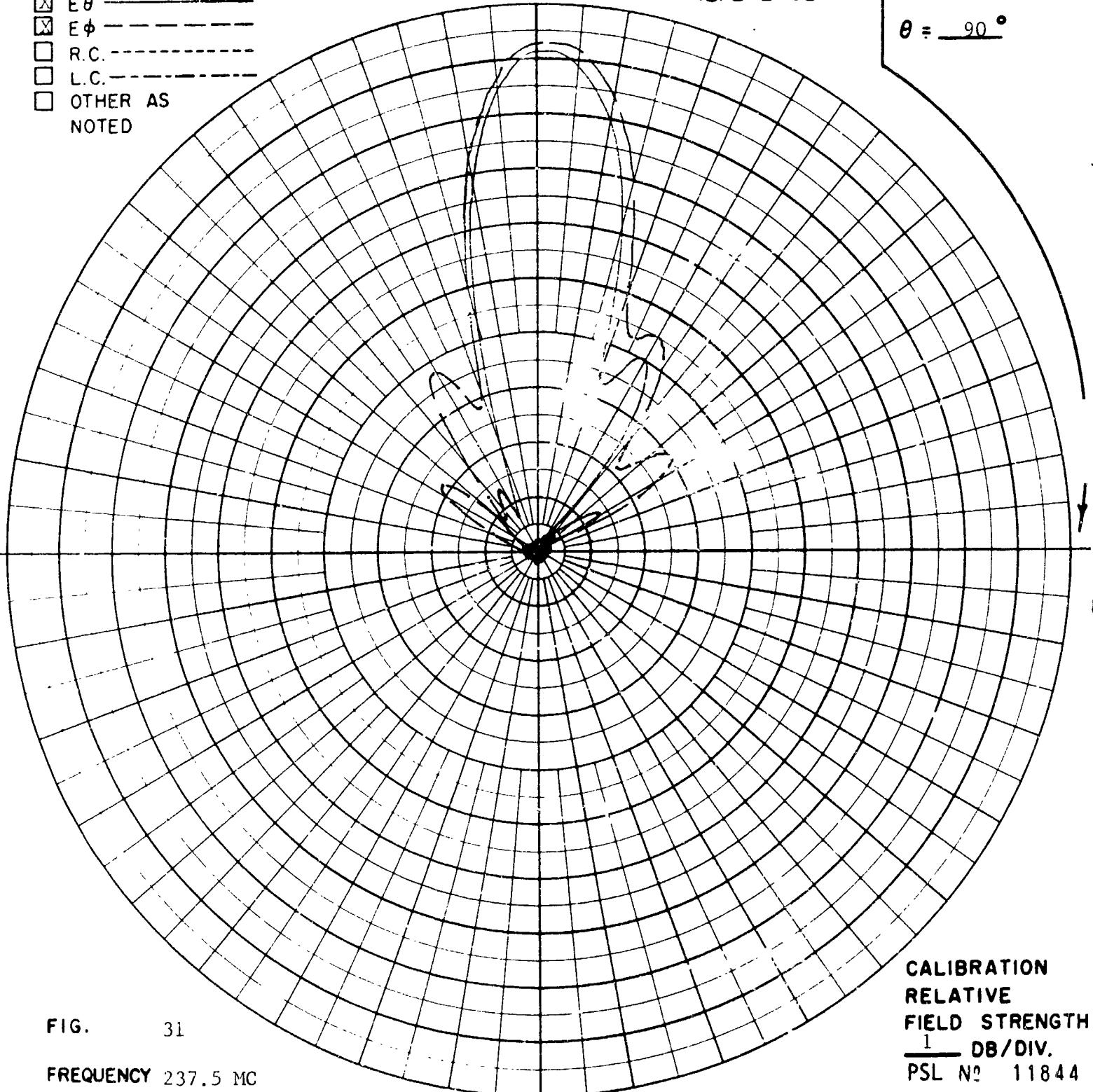
CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11824

POLARIZATION

- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
1 DB/DIV.
PSL N° 11844

FIG. 31

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}^{20^{\circ}}$
 $\theta = \underline{\hspace{2cm}}^{90^{\circ}}$

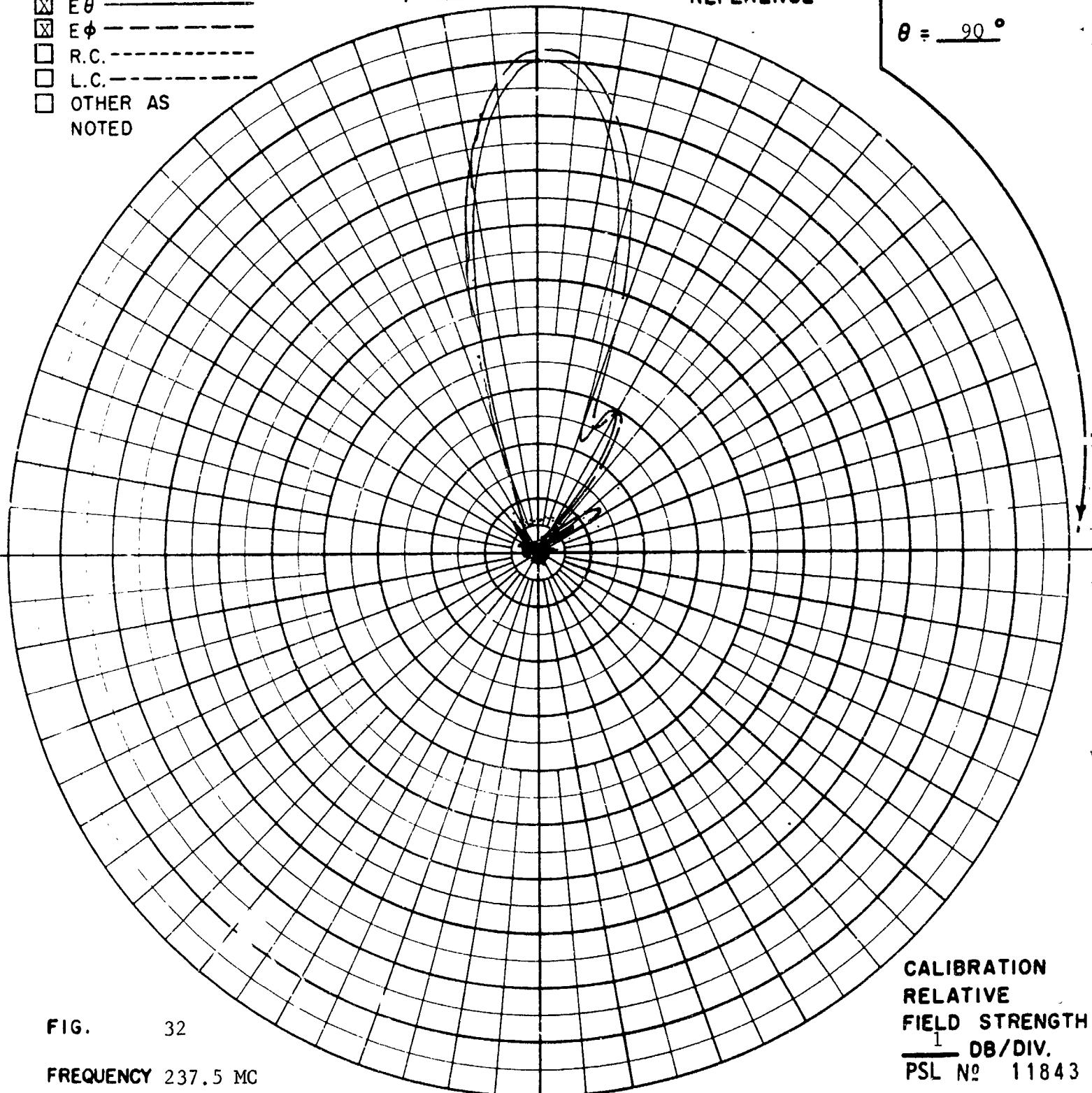


FIG. 32

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

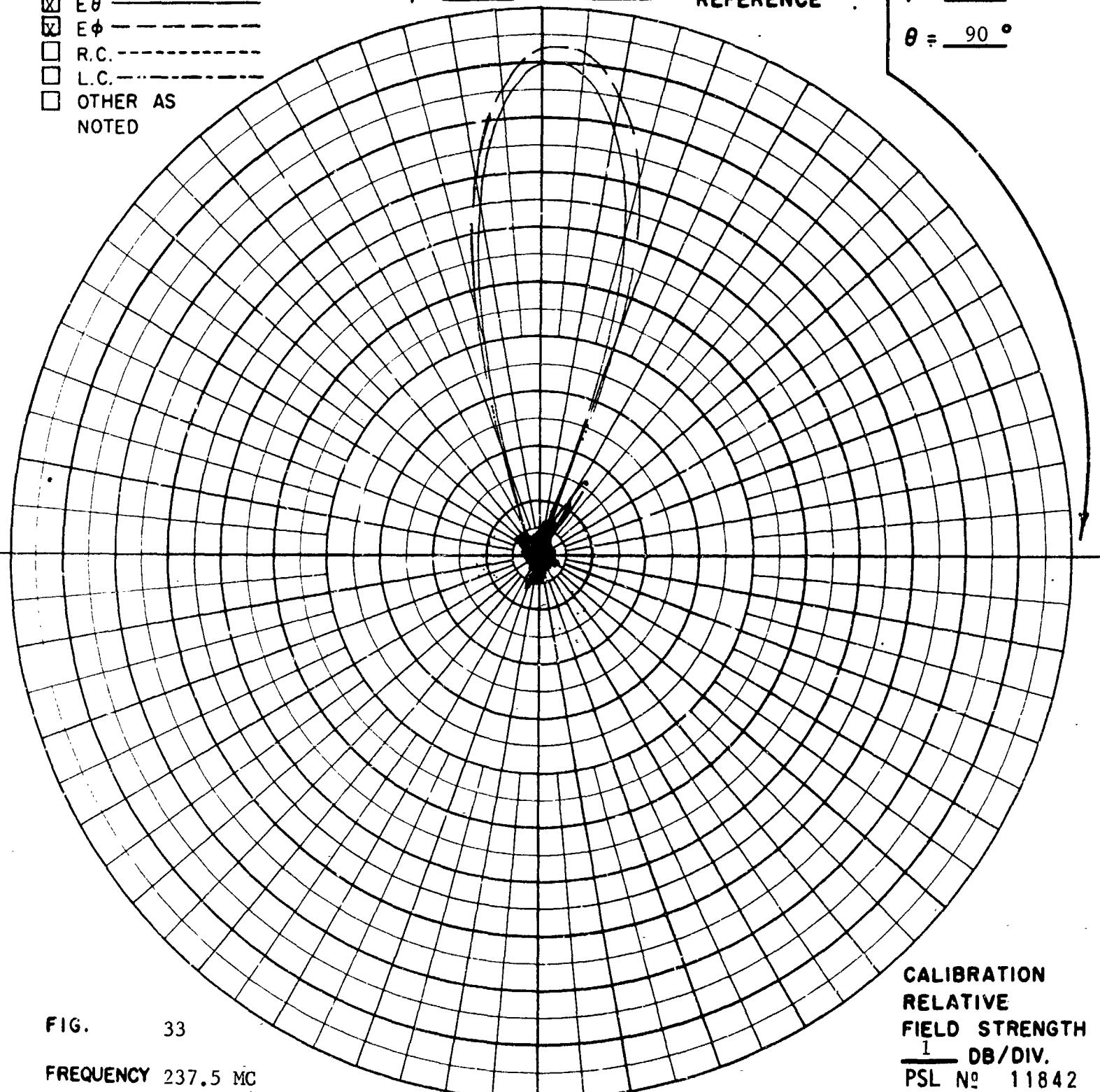
CALIBRATION
RELATIVE
FIELD STRENGTH -
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11843

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11842

FIG. 33

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ 40 °
 $\theta = \underline{\hspace{1cm}}$ 90 °

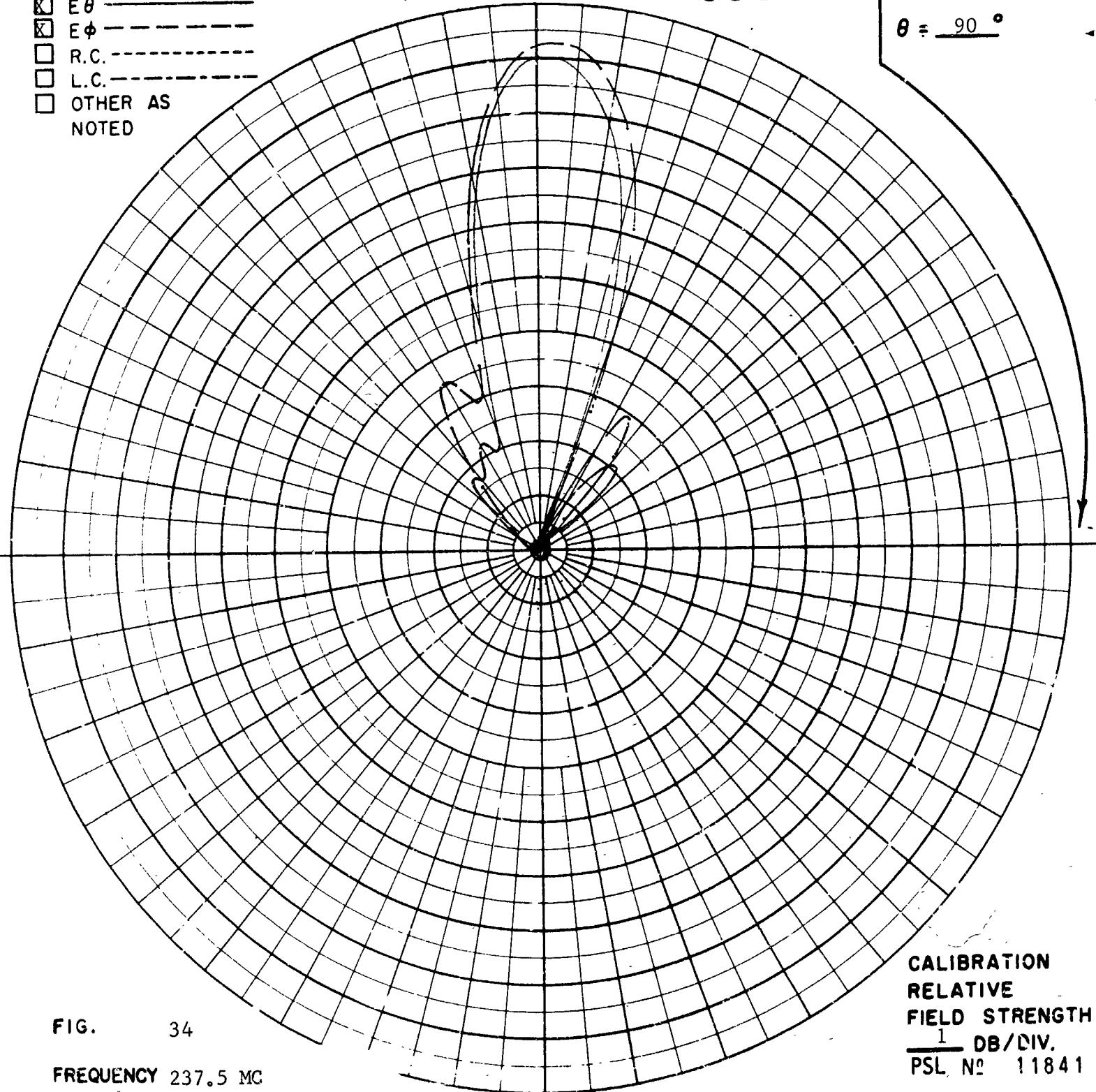


FIG. 34

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
1 DB/DIV.
PSL N° 11841

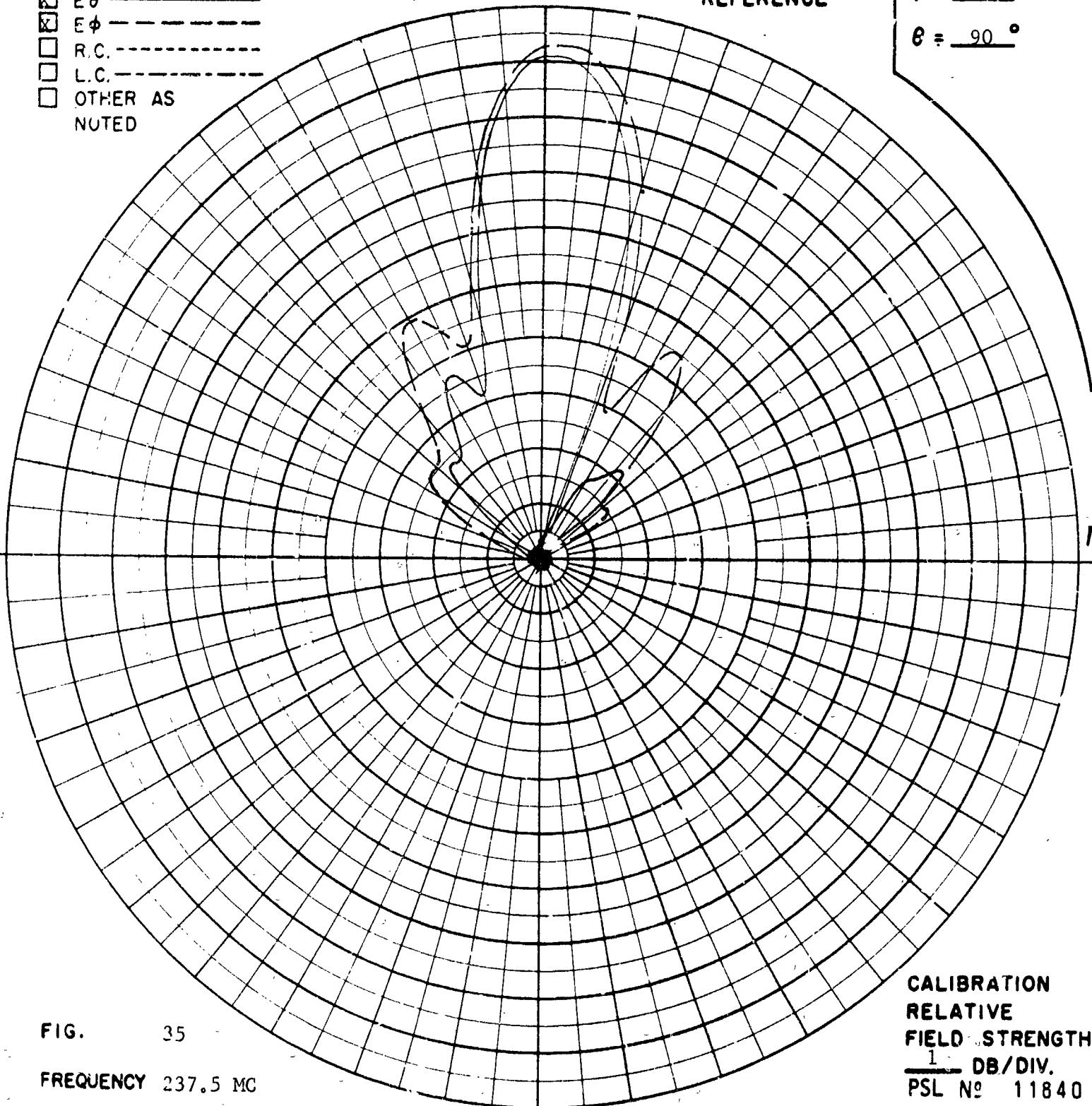
POLARIZATION

- GAIN REF -----
- E_θ _____
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}^{\circ}$
 $\theta = \underline{\hspace{2cm}}^{\circ}$



CALIBRATION
RELATIVE
FIELD STRENGTH
1 DB/DIV.
PSL № 11840

FIG. 35

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
 E θ -----
 E ϕ -----
 R.C. -----
 L.C. -----
 OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ 60 °
 $\theta = \underline{\hspace{2cm}}$ 90 °

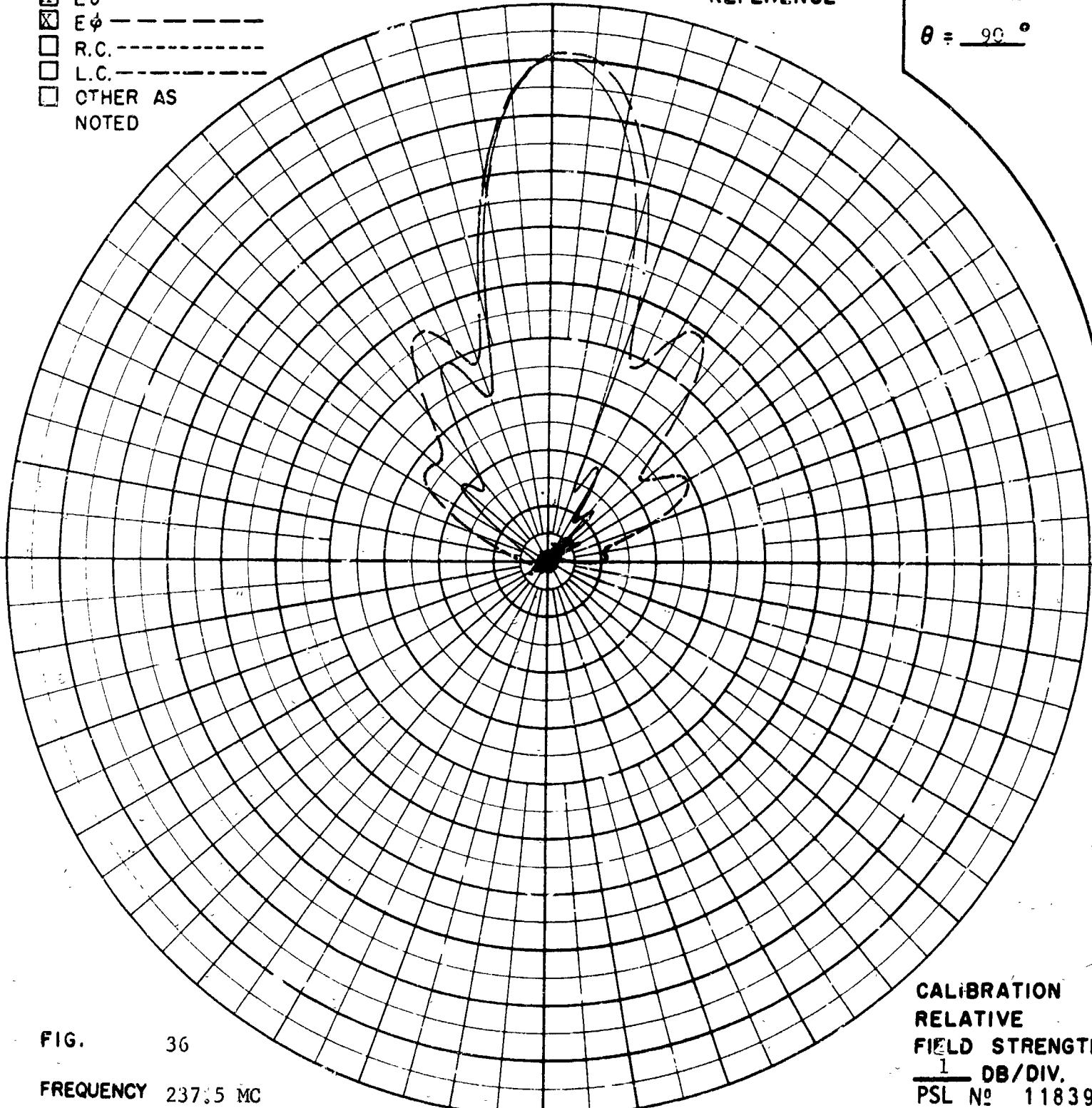


FIG.

36

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
 PSL N° 11839

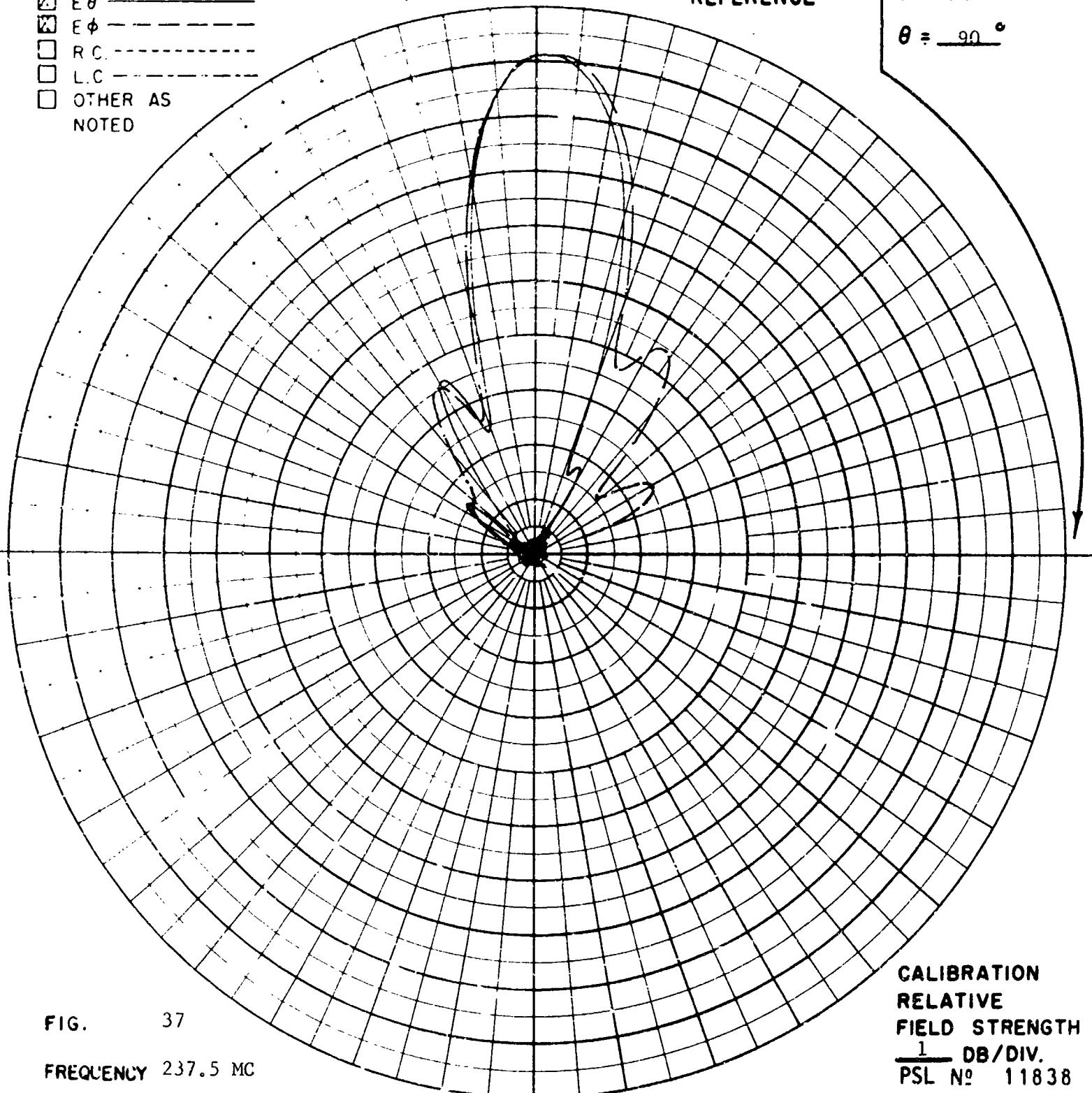
POLARIZATION

- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}^{\circ}$
 $\theta = \underline{\hspace{2cm}}^{\circ}$



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11838

FIG. 37

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

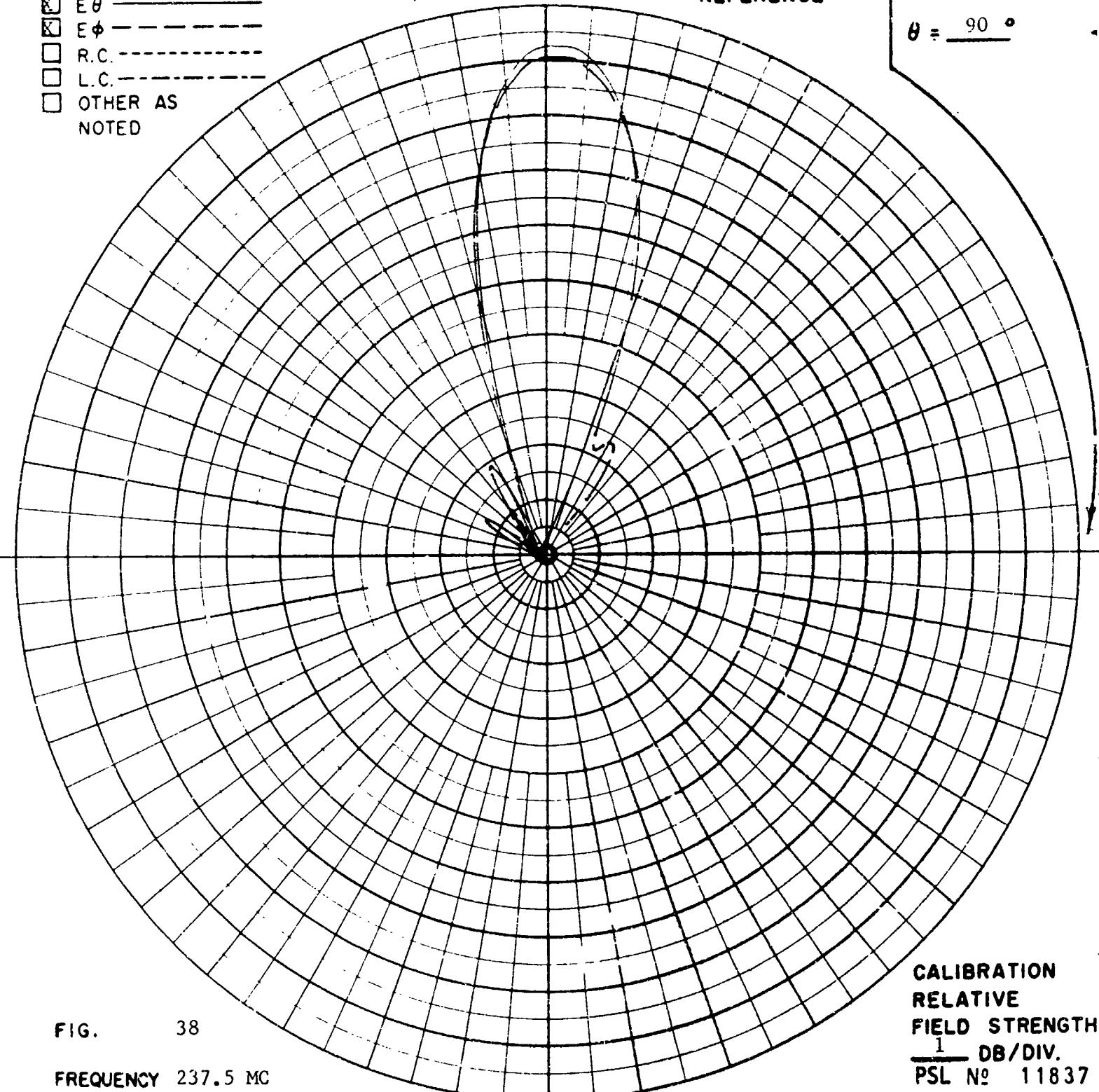
POLARIZATION

- GAIN REF -----
 E θ _____
 E ϕ -----
 R.C. -----
 L.C. -----
 OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °
 $\theta = \underline{\hspace{1cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11837

FIG. 38

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX APPAY

REMARKS

POLARIZATION

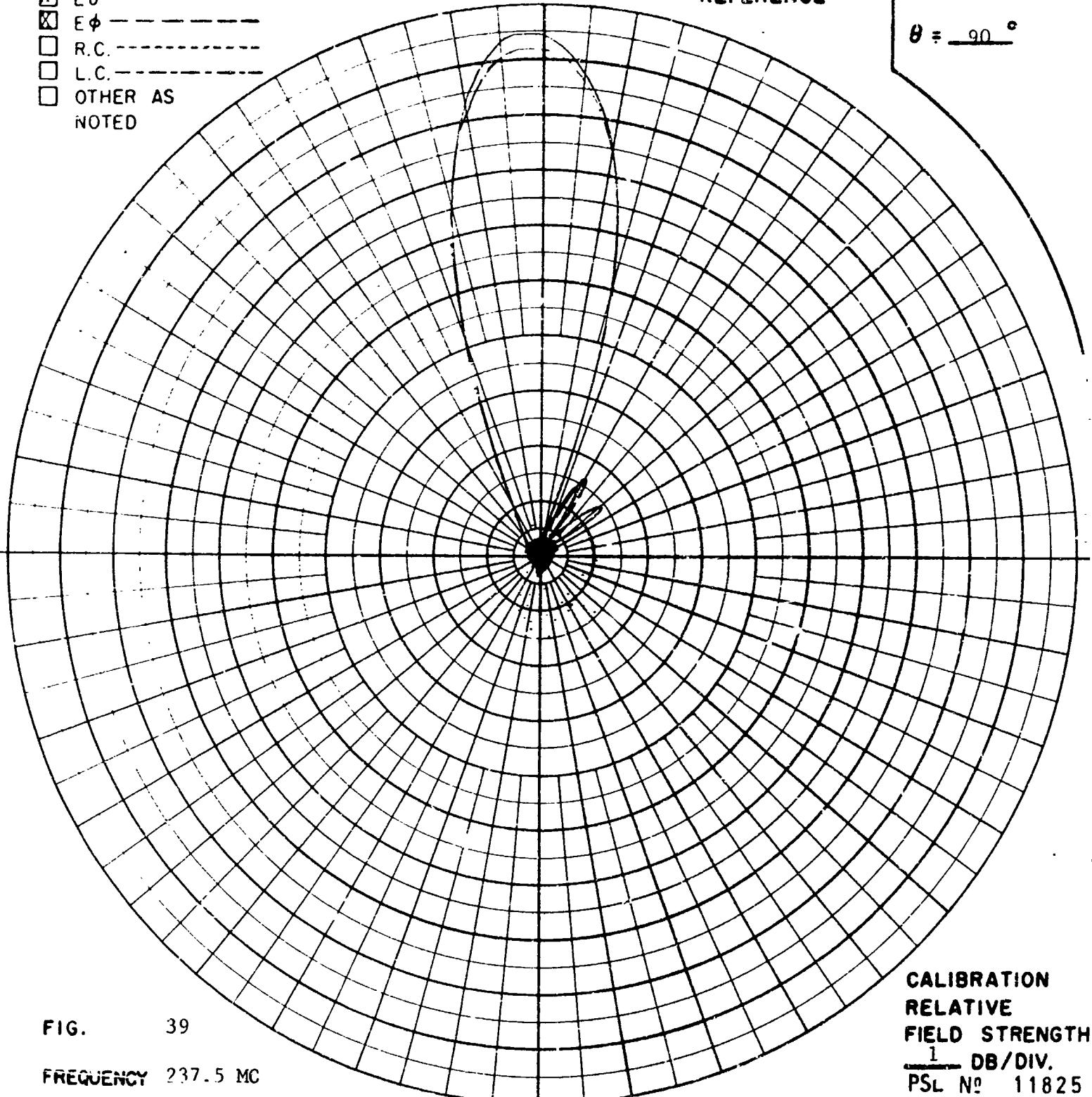
- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °

$\theta = \underline{\hspace{2cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11825

FIG. 39

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
- E_θ _____
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{100}$ °
 $\theta = \underline{90}$ °

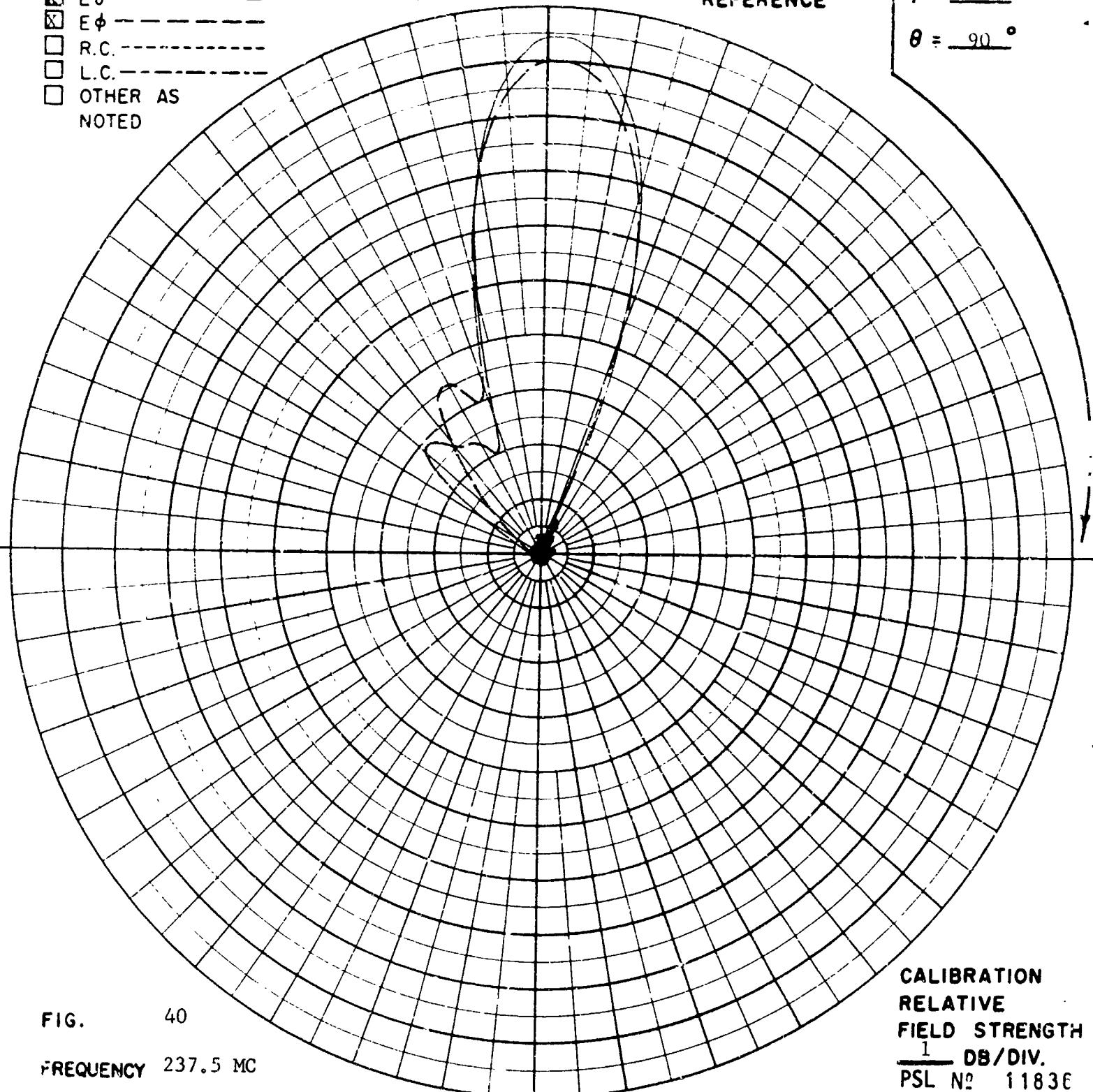


FIG. 40

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

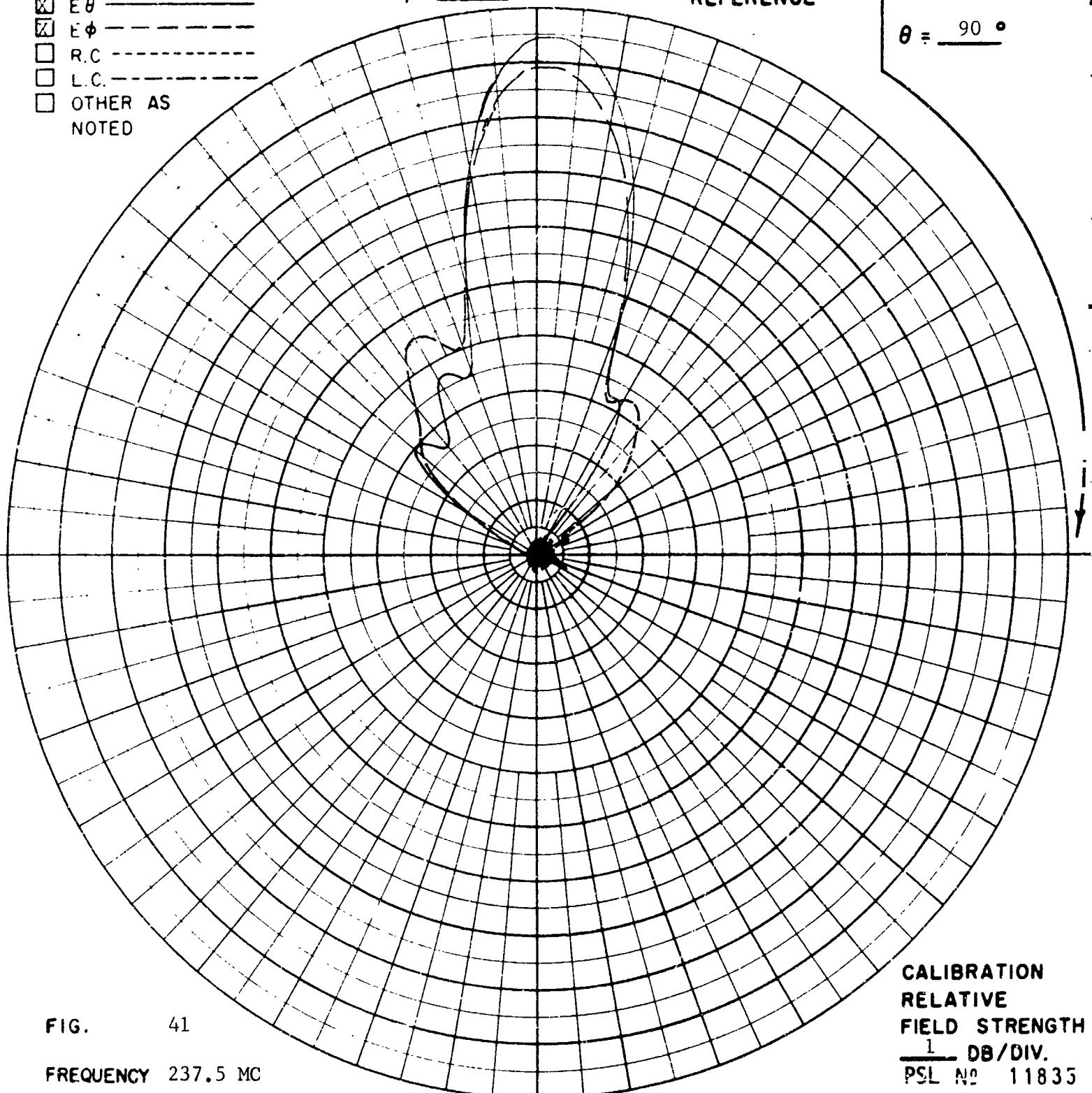
CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 1183E

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}} 0$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}} 110$ °
 $\theta = \underline{\hspace{2cm}} 90$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
1 DB/DIV.
PSL NO 11835

FIG. 41

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

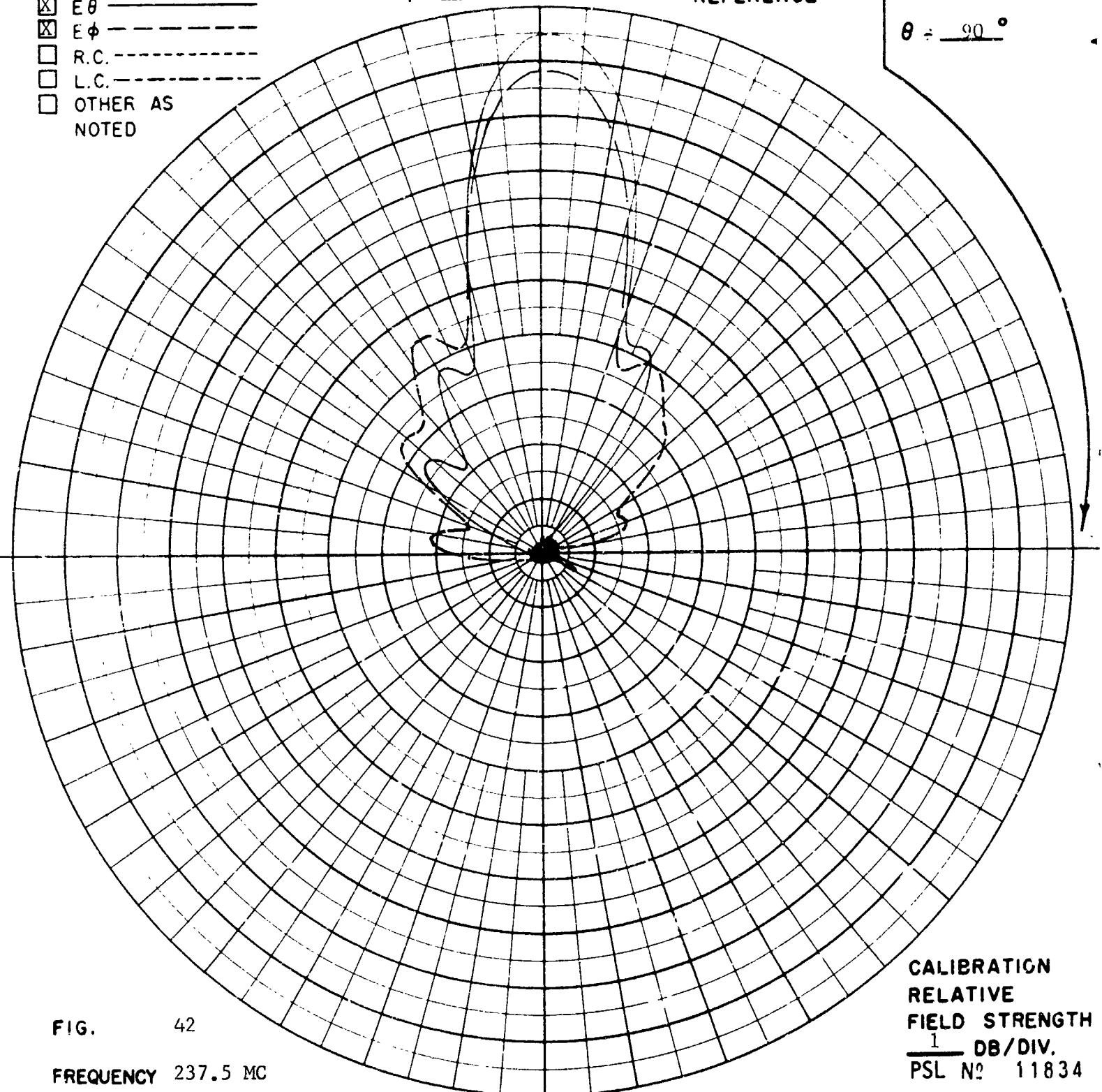
POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °
 $\theta = \underline{\hspace{1cm}}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
1 DB/DIV.
PSL N^o 11834

FIG. 42

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$ COORDINATE
REFERENCE

$\phi = \underline{130}^{\circ}$
 $\theta = \underline{90}^{\circ}$

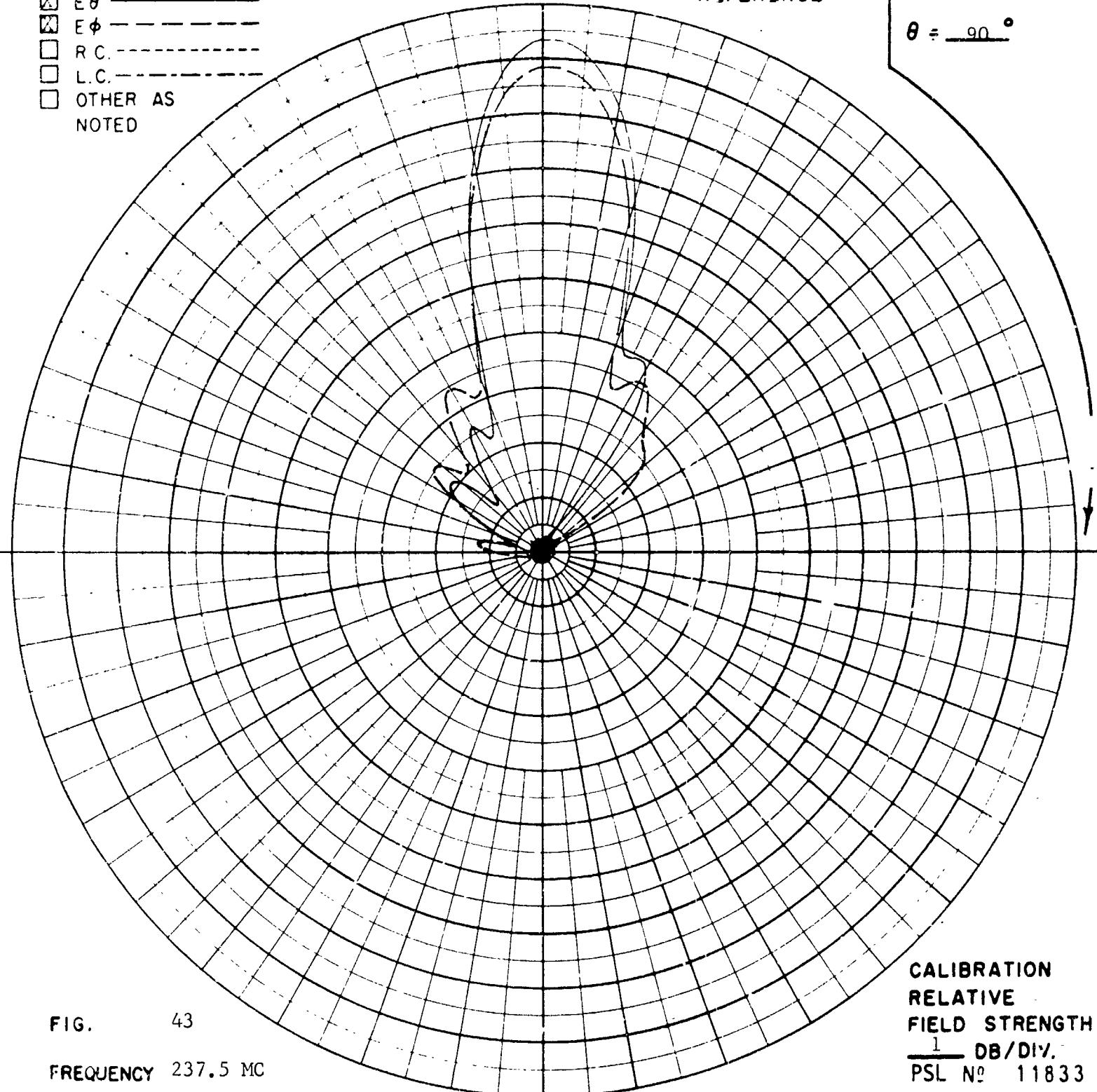


FIG. 43

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11833

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °

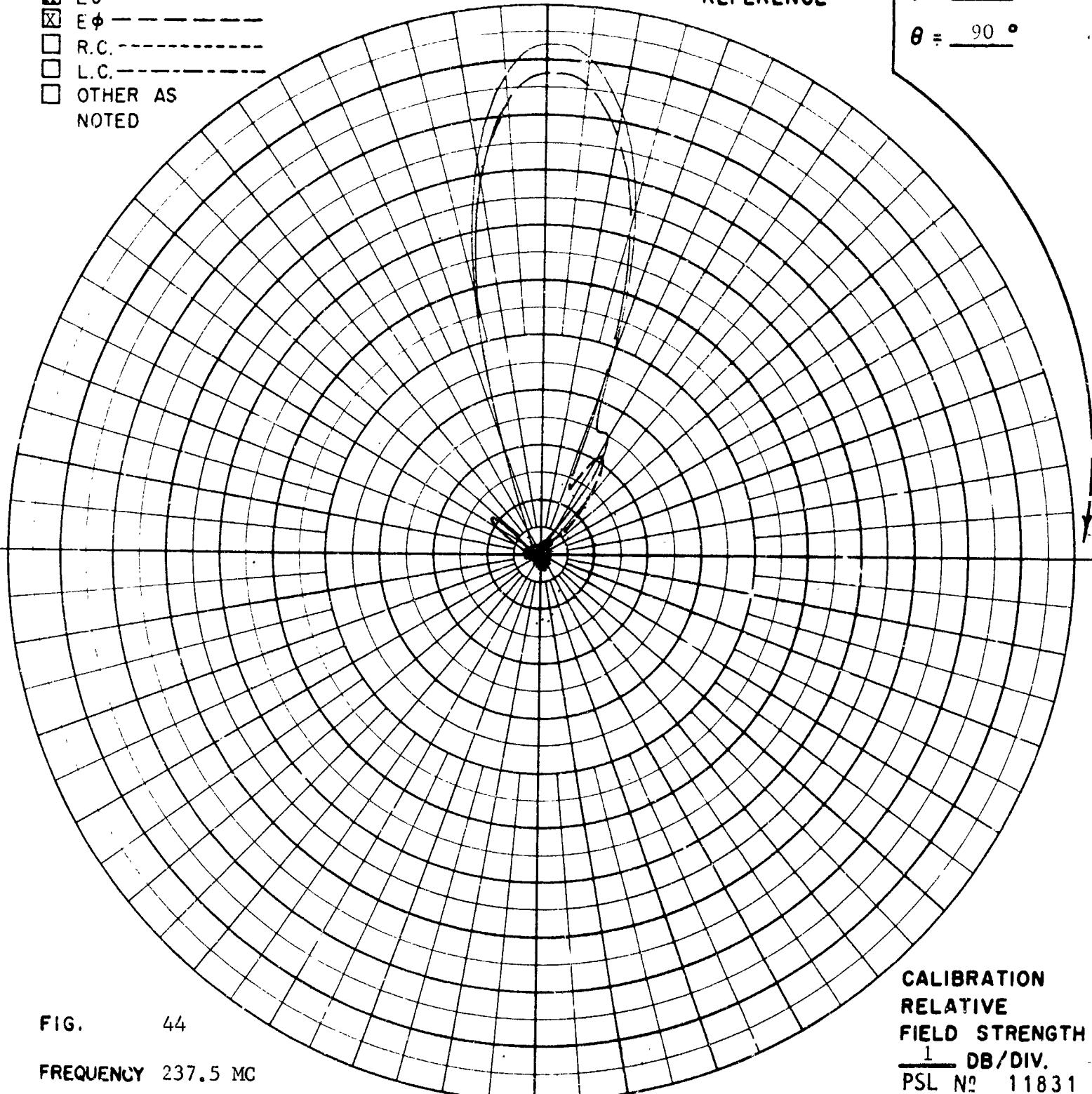


FIG.

44

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
1 DB/DIV.
PSL N° 11831

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °

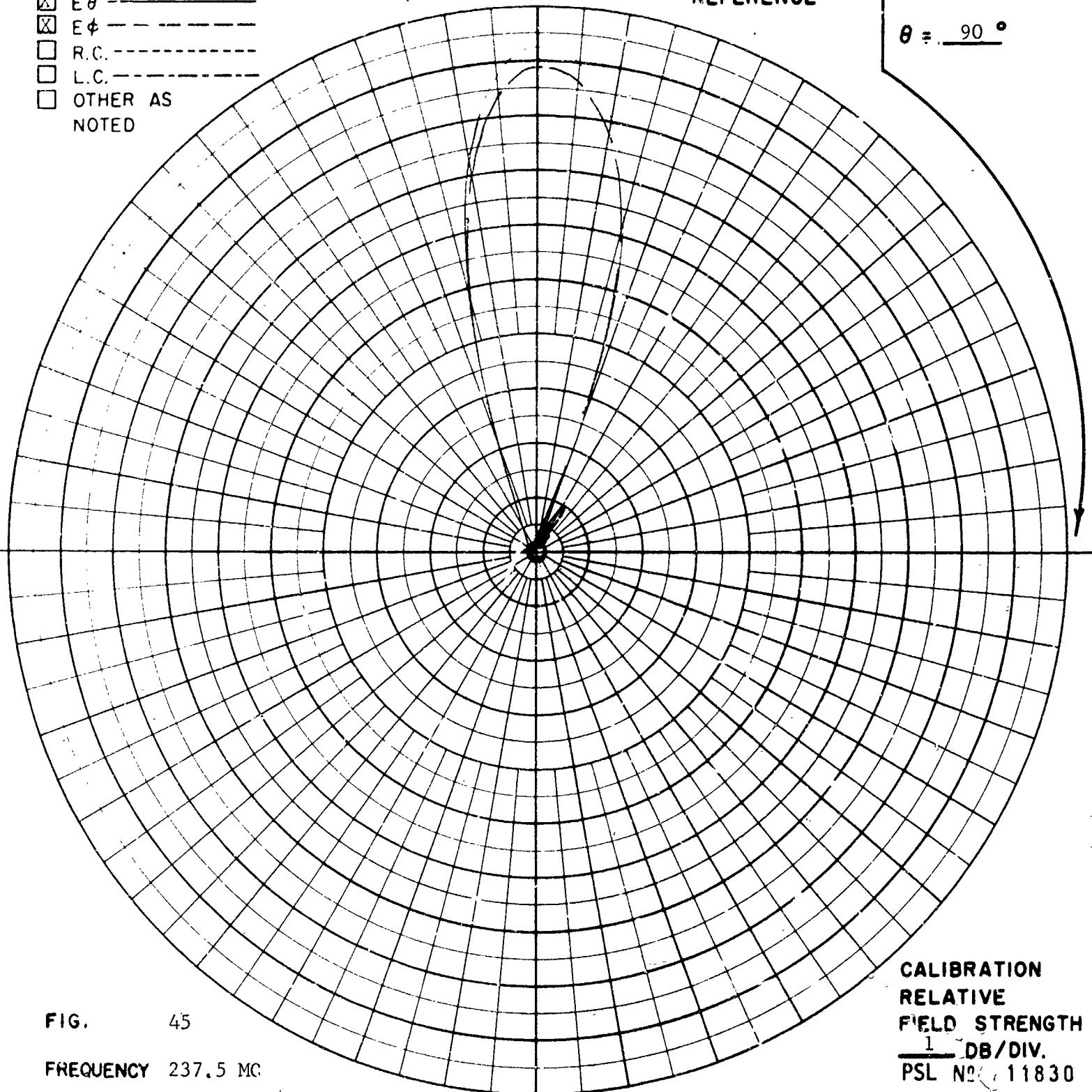


FIG. 45

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11830

POLARIZATION

- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{160}$ °
 $\theta = \underline{90}$ °

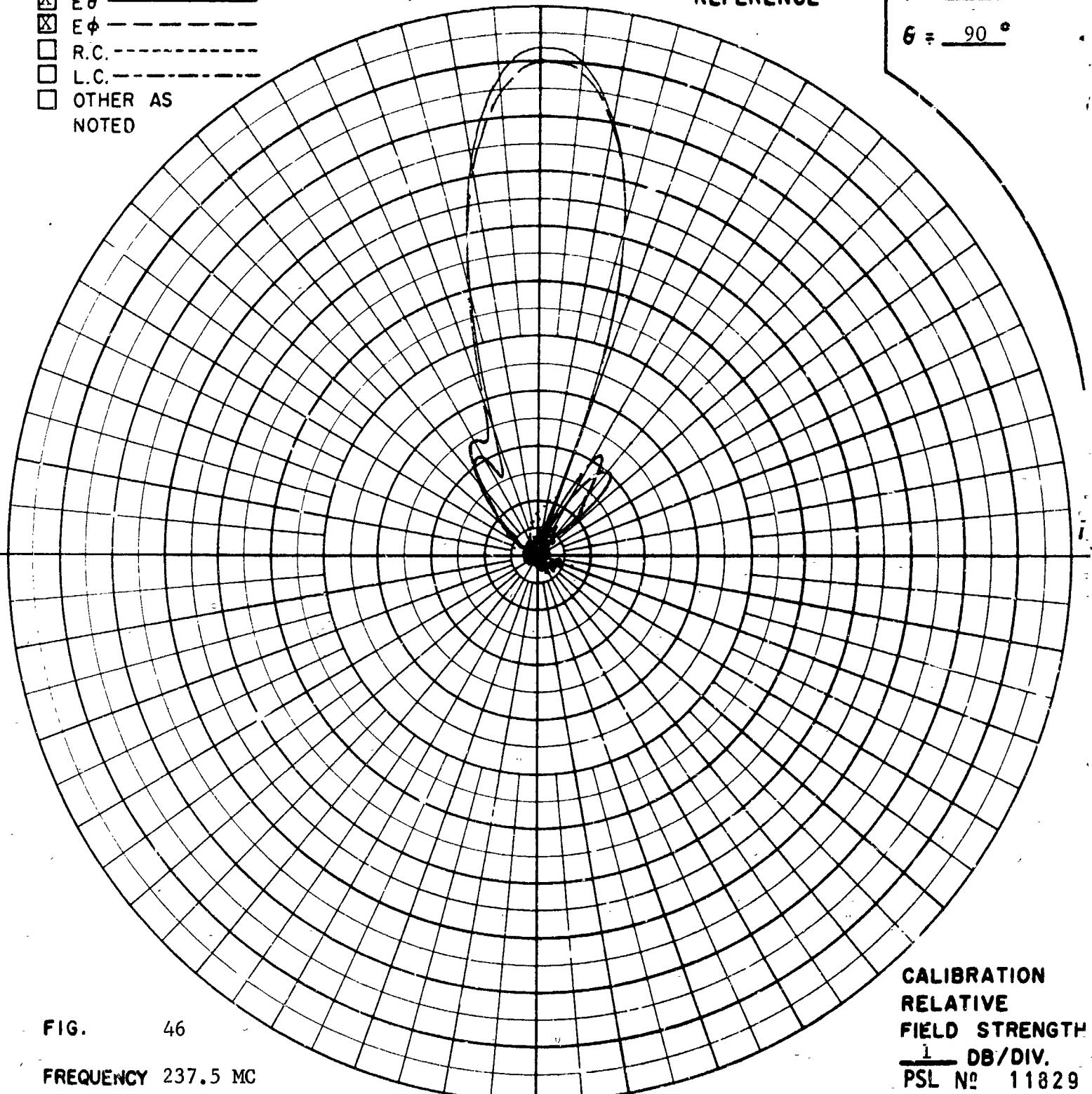


FIG. 46

FREQUENCY 237.5 MC

ANTENNA T⁺ - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11829

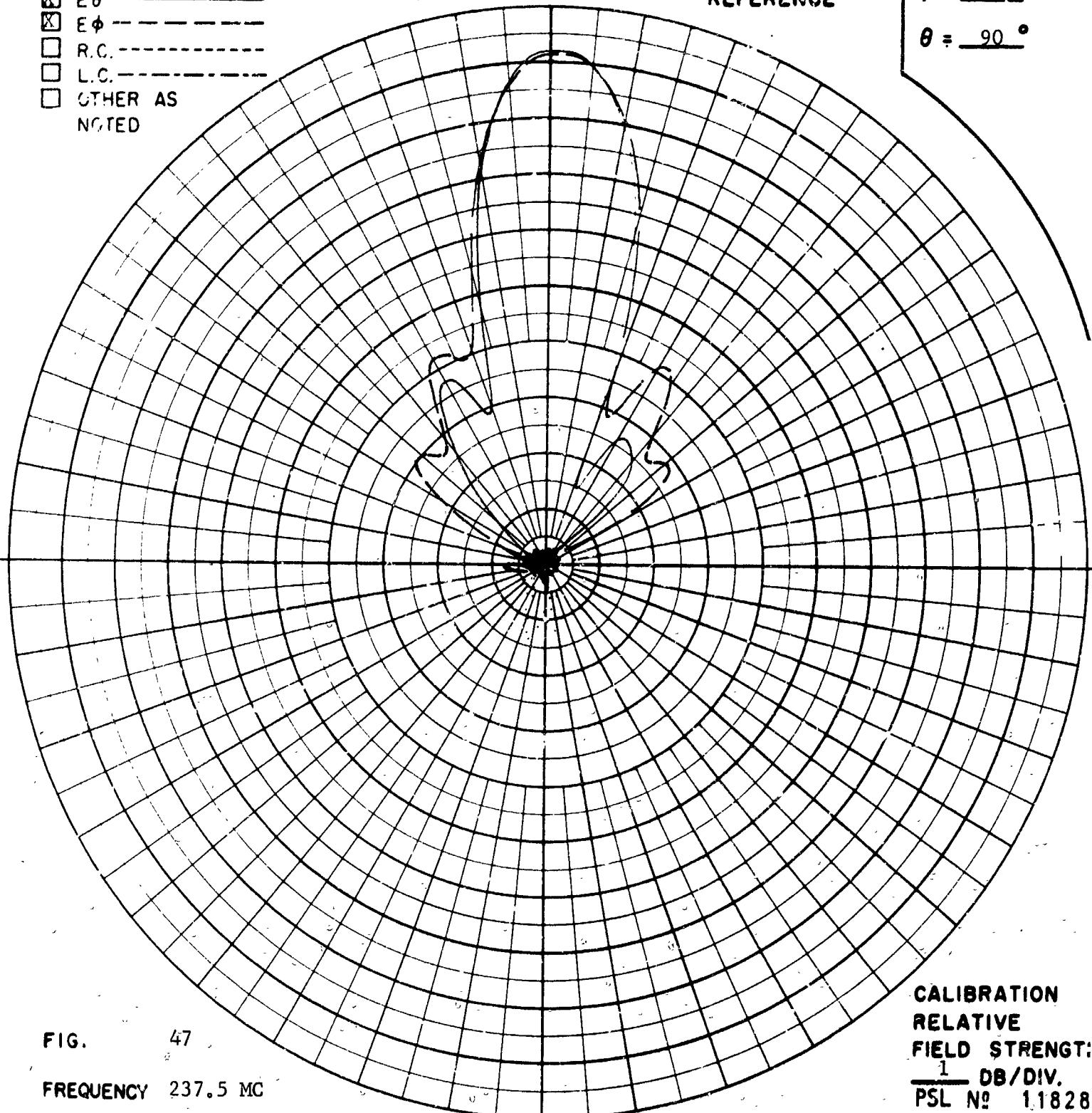
POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

ϕ_3 _____ $^{\circ}$ $\theta =$ 0 $^{\circ}$

COORDINATE
REFERENCE

$\phi =$ 170 $^{\circ}$
 $\theta =$ 90 $^{\circ}$



CALIBRATION
RELATIVE
FIELD STRENGTH:
1 DB/DIV.
PSL N° 11828

FIG. 47

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}^{\circ}$

$\theta = \underline{\hspace{2cm}}^{\circ}$

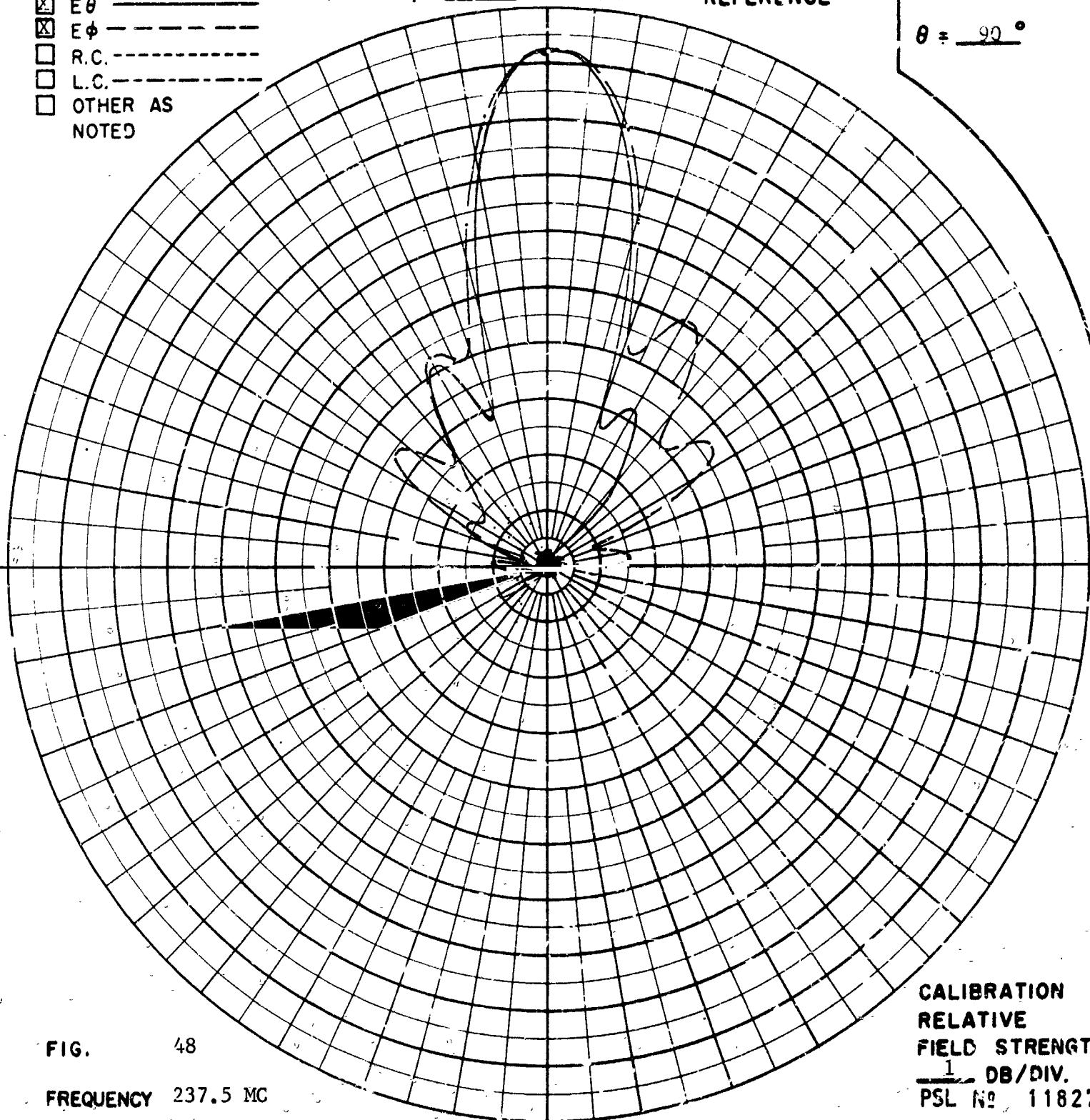


FIG. 48

FREQUENCY 237.5 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

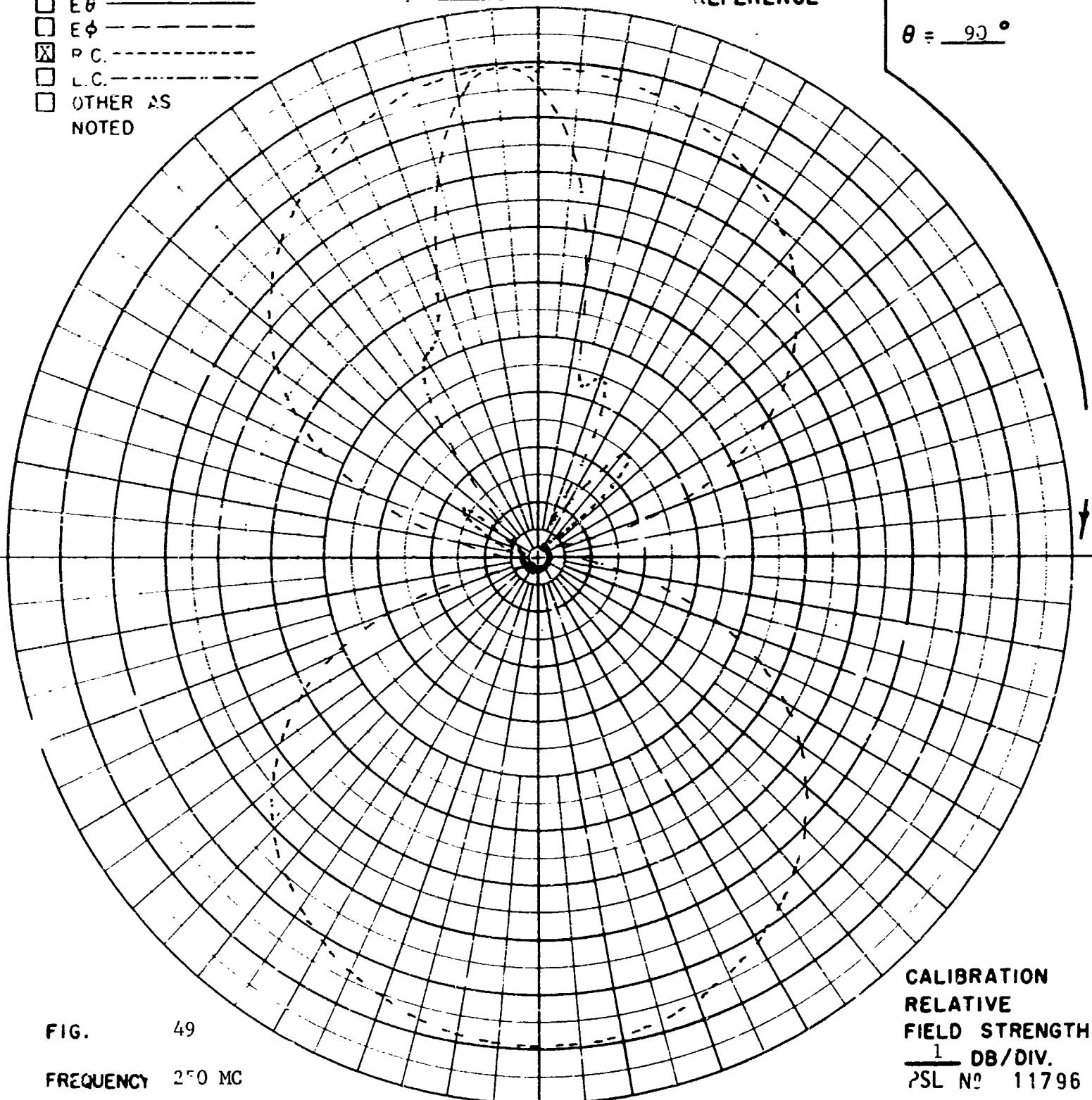
CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11827

POLARIZATION

- GAIN REF -----
 E θ _____
 E ϕ -----
 P.C. -----
 L.C. -----
 OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$ COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}^{\circ}$
 $\theta = \underline{\hspace{2cm}}^{\circ}$



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11796

FIG. 49

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS TRI - HELIX GAIN AT $\phi = 0^{\circ}$, $\theta = 0^{\circ}$ IS 16.0 DB OVER REFERENCE DIPOLE.
TRI - HELIX (R. C.) HAS 16.0 DB ATTENUATION ADDED TO TRANSMISSION LINE.

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}^{\circ}$
 $\theta = \underline{\hspace{2cm}}^{\circ}$

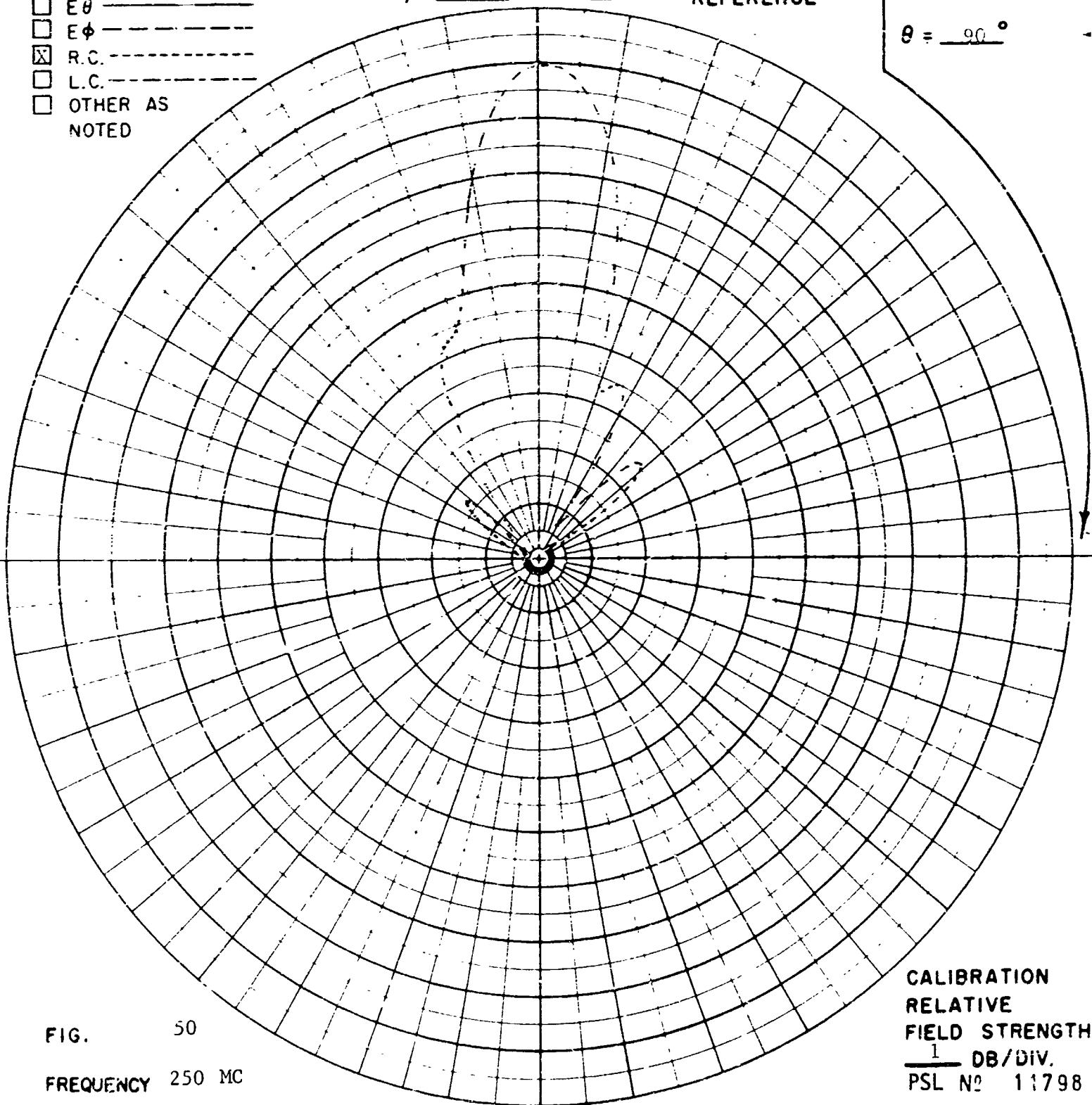


FIG.

50

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11798

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER .S
NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}} 0$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ 30 °

$\theta = \underline{\hspace{1cm}}$ 90 °

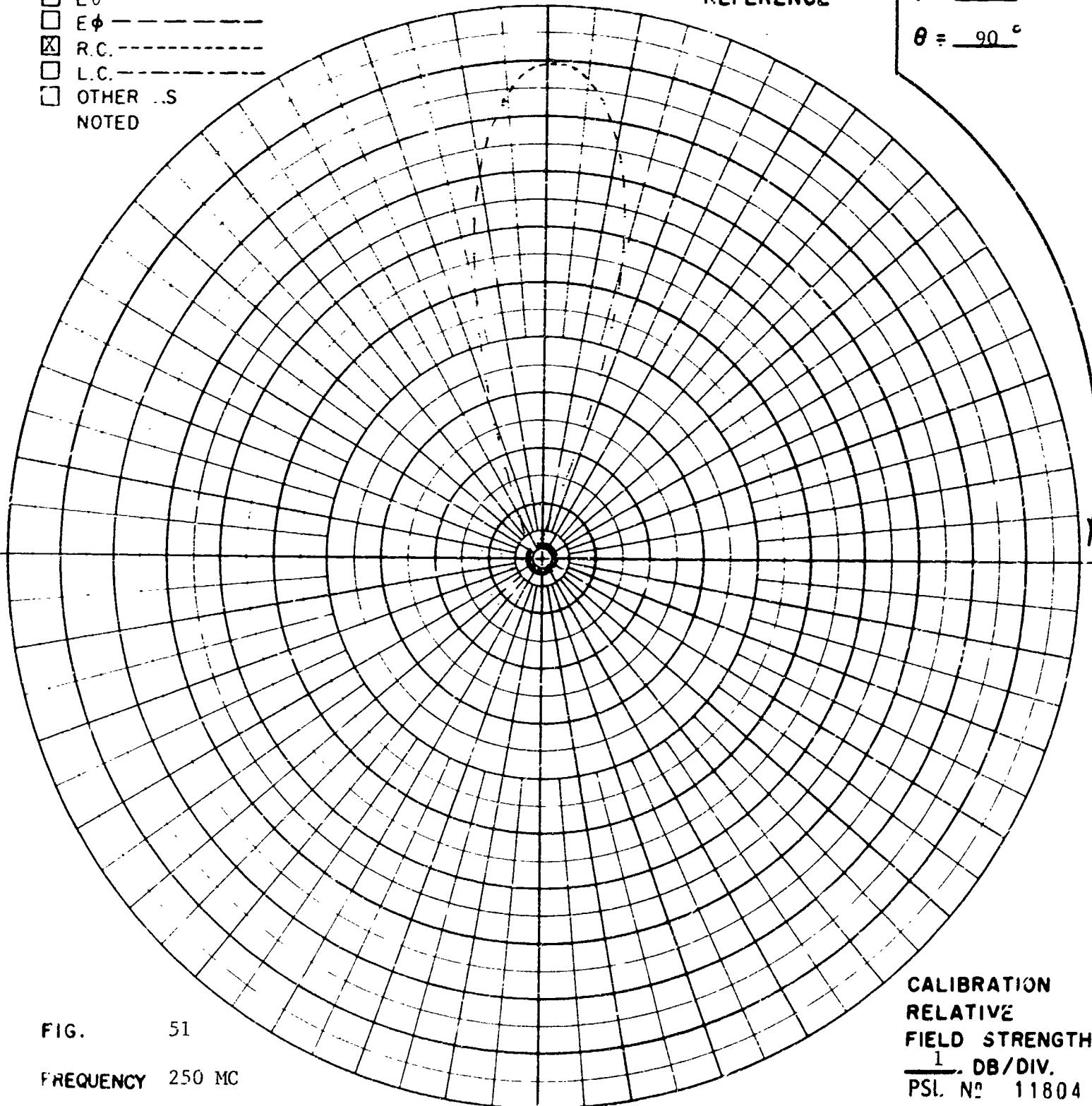


FIG. 51

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11804

POLARIZATION

- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °
 $\theta = \underline{\hspace{1cm}}$ °

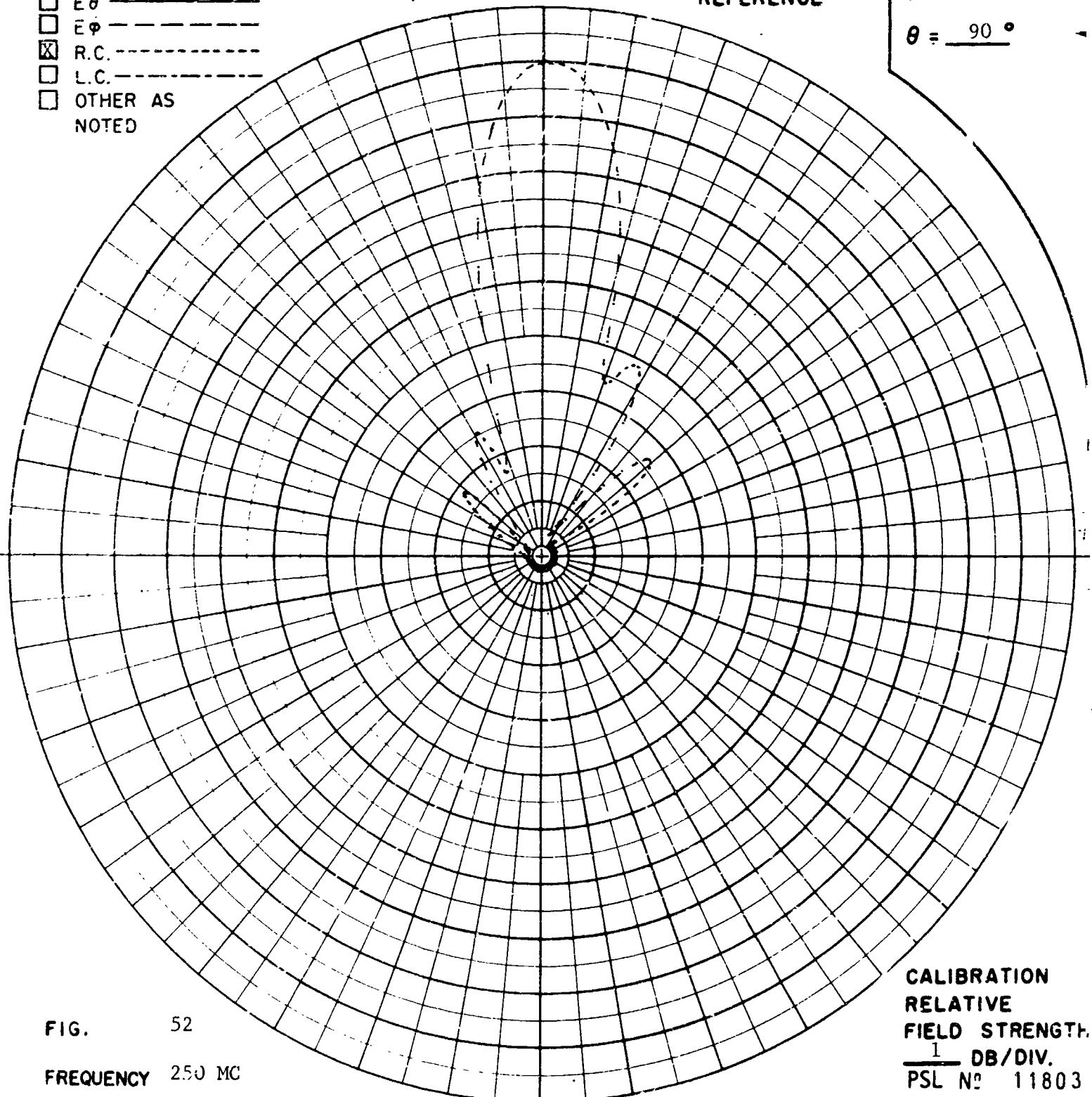


FIG. 52

FREQUENCY 25.0 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11803

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °

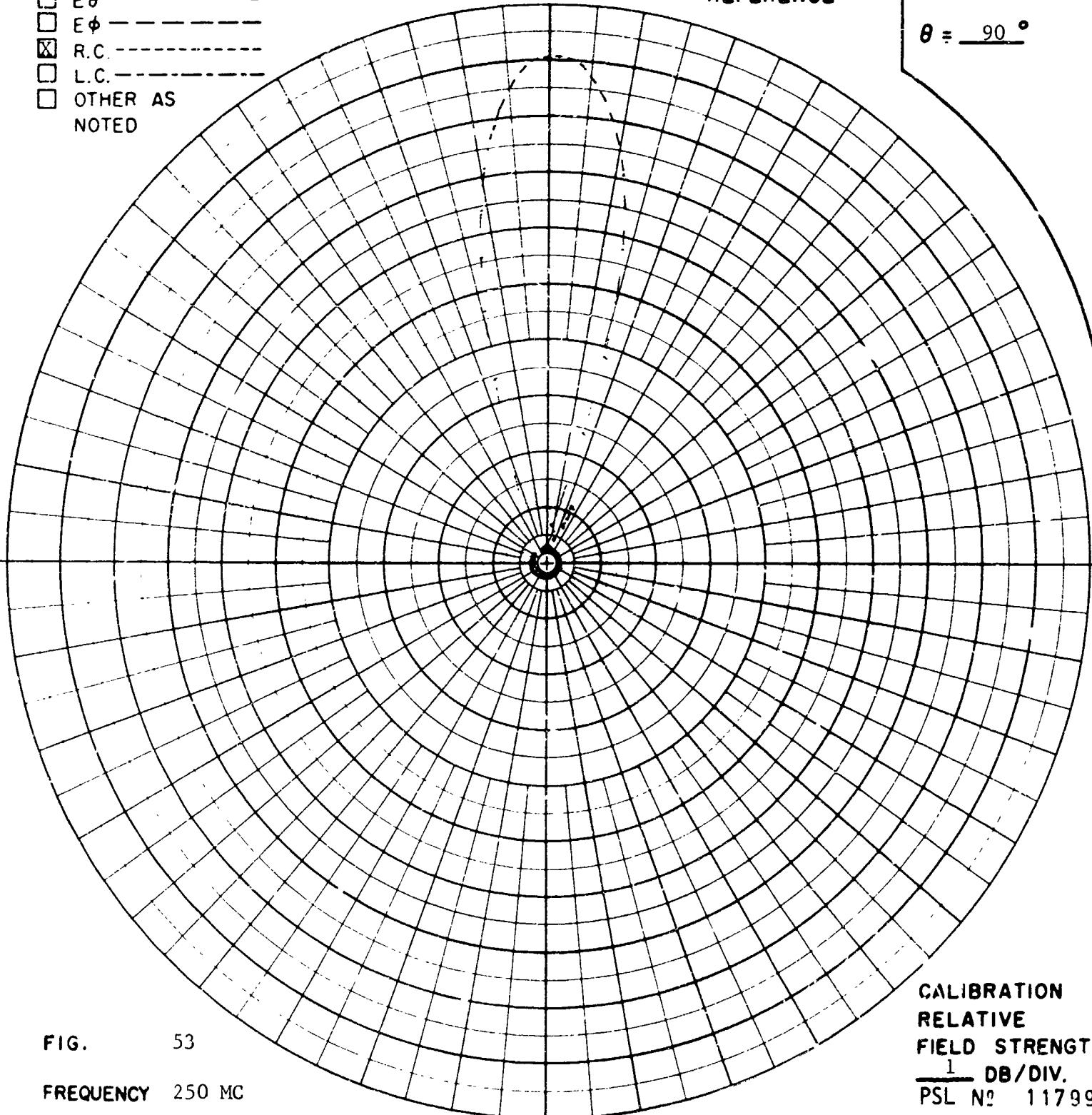


FIG. 53

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11799

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °

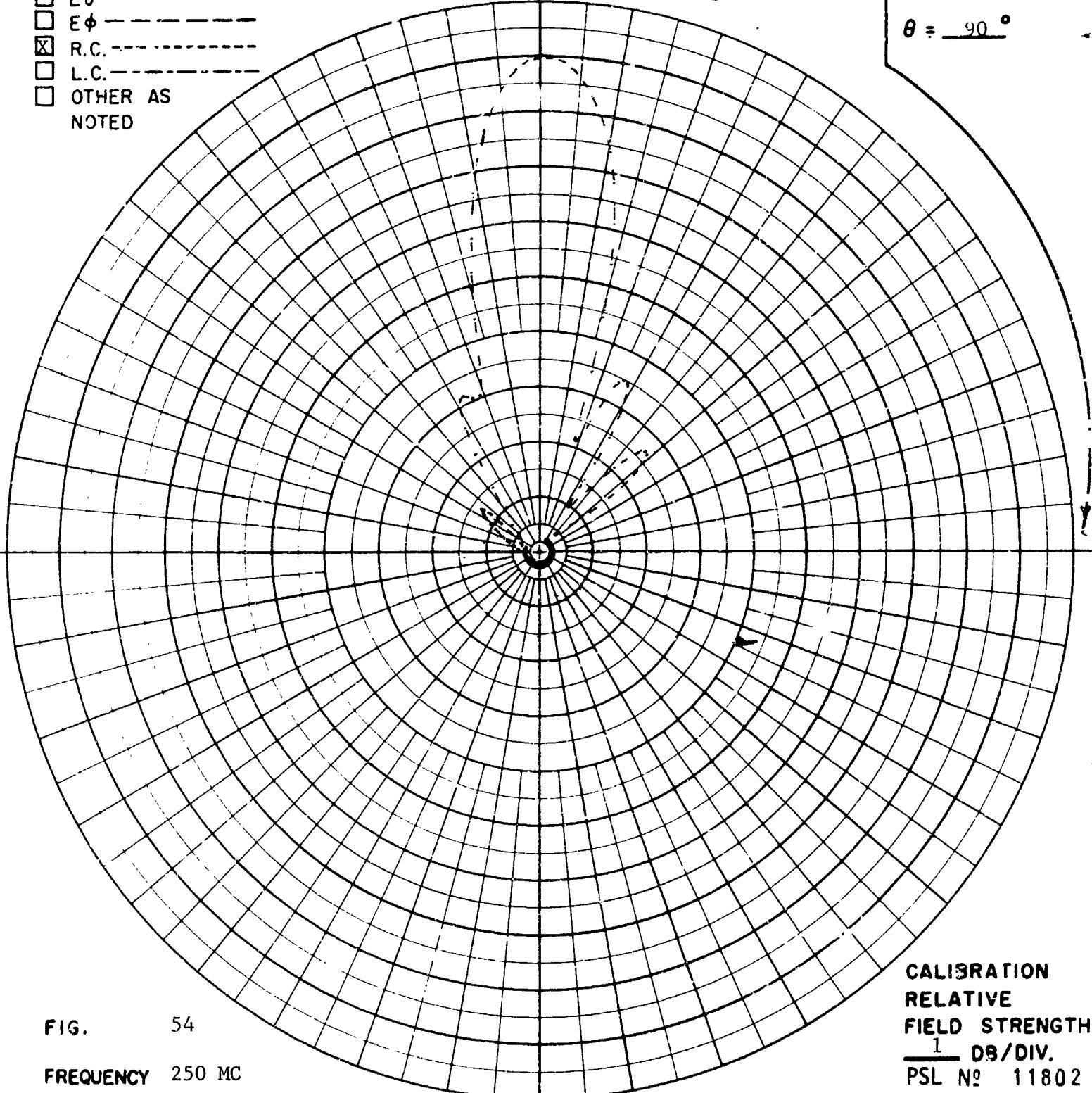


FIG. 54

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11802

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ 150 °
 $\theta = \underline{\hspace{2cm}}$ 90 °

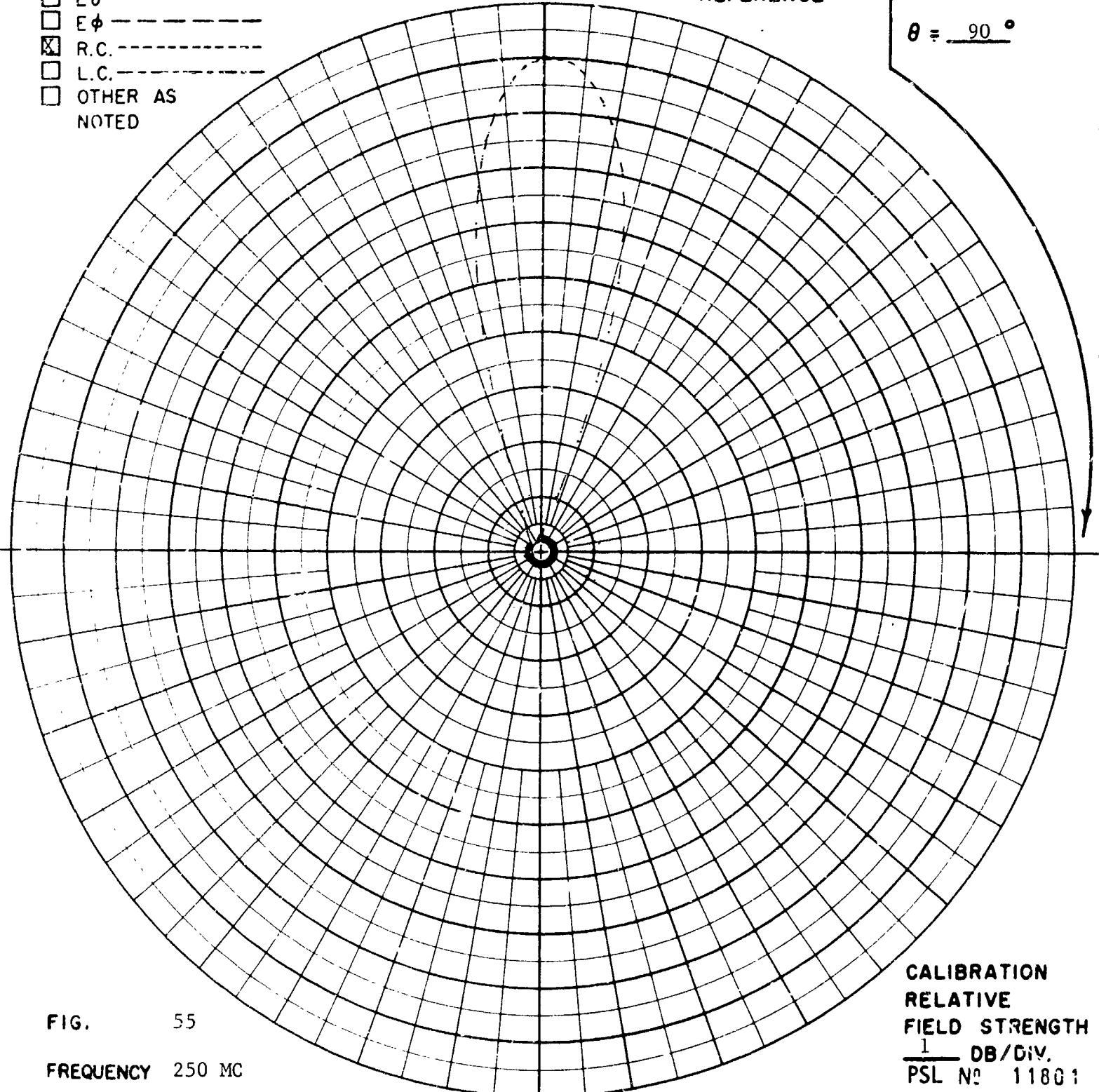


FIG. 55

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL No 11801

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °

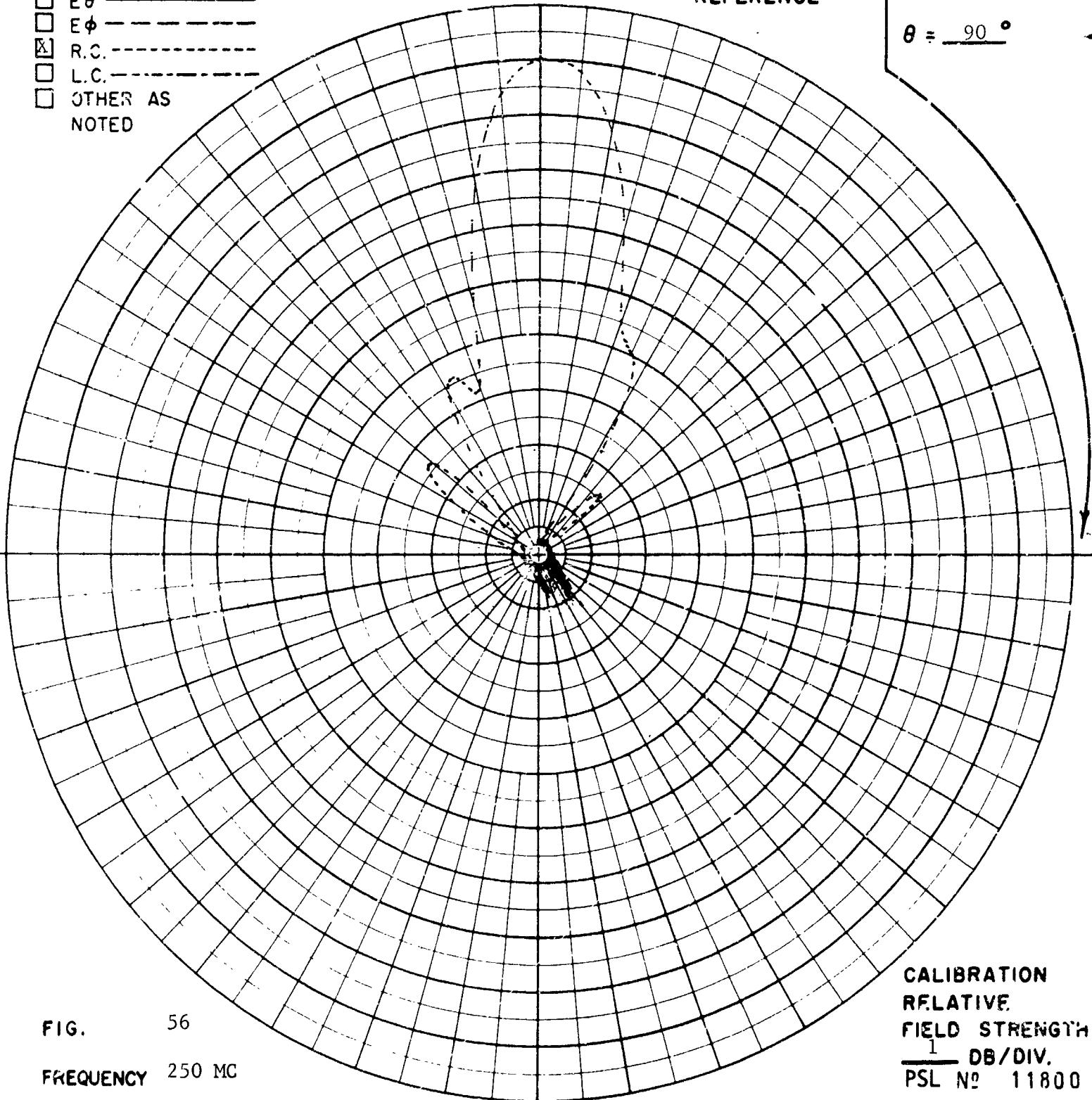


FIG.

56

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11800

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}^{\circ}$ $\theta = \underline{\hspace{1cm}}^{\circ}$

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}^{\circ}$
 $\theta = \underline{\hspace{1cm}}^{\circ}$

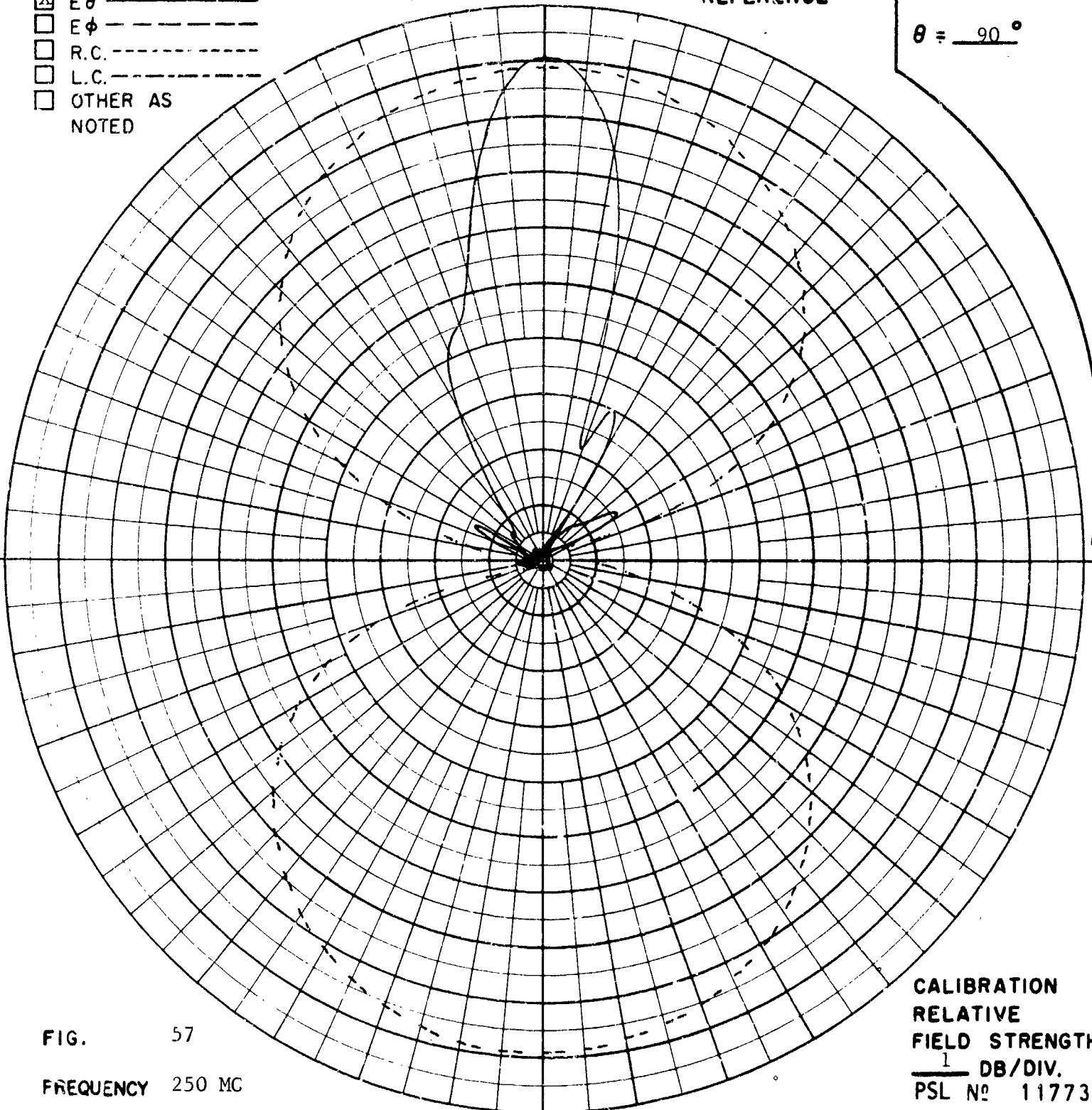


FIG. 57

FREQUENCY 250 MC

ANTL N.D. TRI - HELIX ARRAY

REMARKS TRI - HELIX GAIN AT $\theta = 0^{\circ}$, $\phi = 0^{\circ}$ IS 10.5 DB OVER REFERENCE DIPOLE.
TRI - HELIX ($E\theta$) HAS 10.0 DB ATTENUATION ADDED TO TRANSMISSION LINE.

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11773

POLARIZATION

- GAIN REF -----
- E_θ _____
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{1cm}}$ ° $\theta = \underline{\hspace{1cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{1cm}}$ °
 $\theta = \underline{\hspace{1cm}}$ °

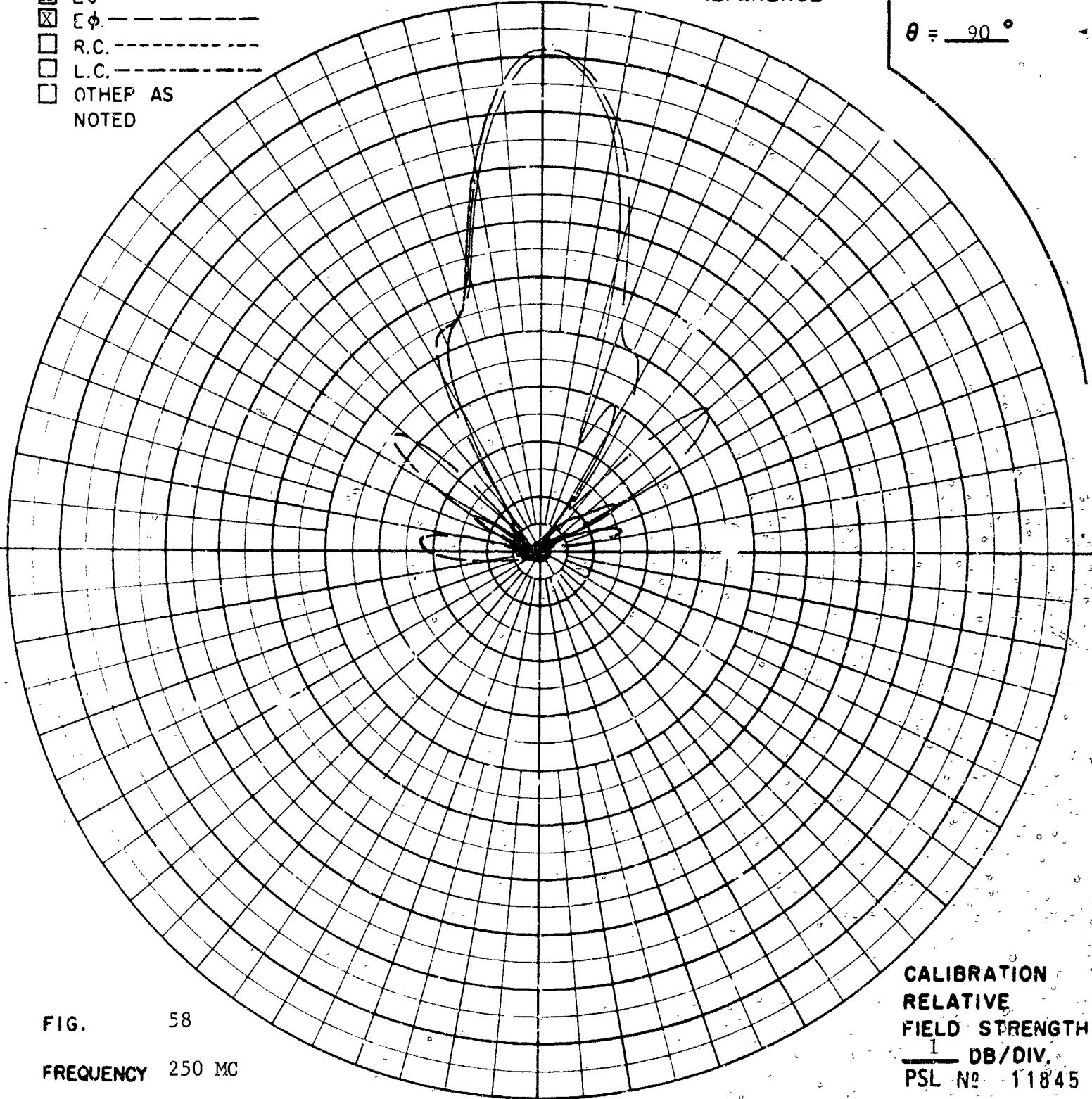


FIG. 58

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL NO 11845

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °

$\theta = \underline{\hspace{2cm}}$ °

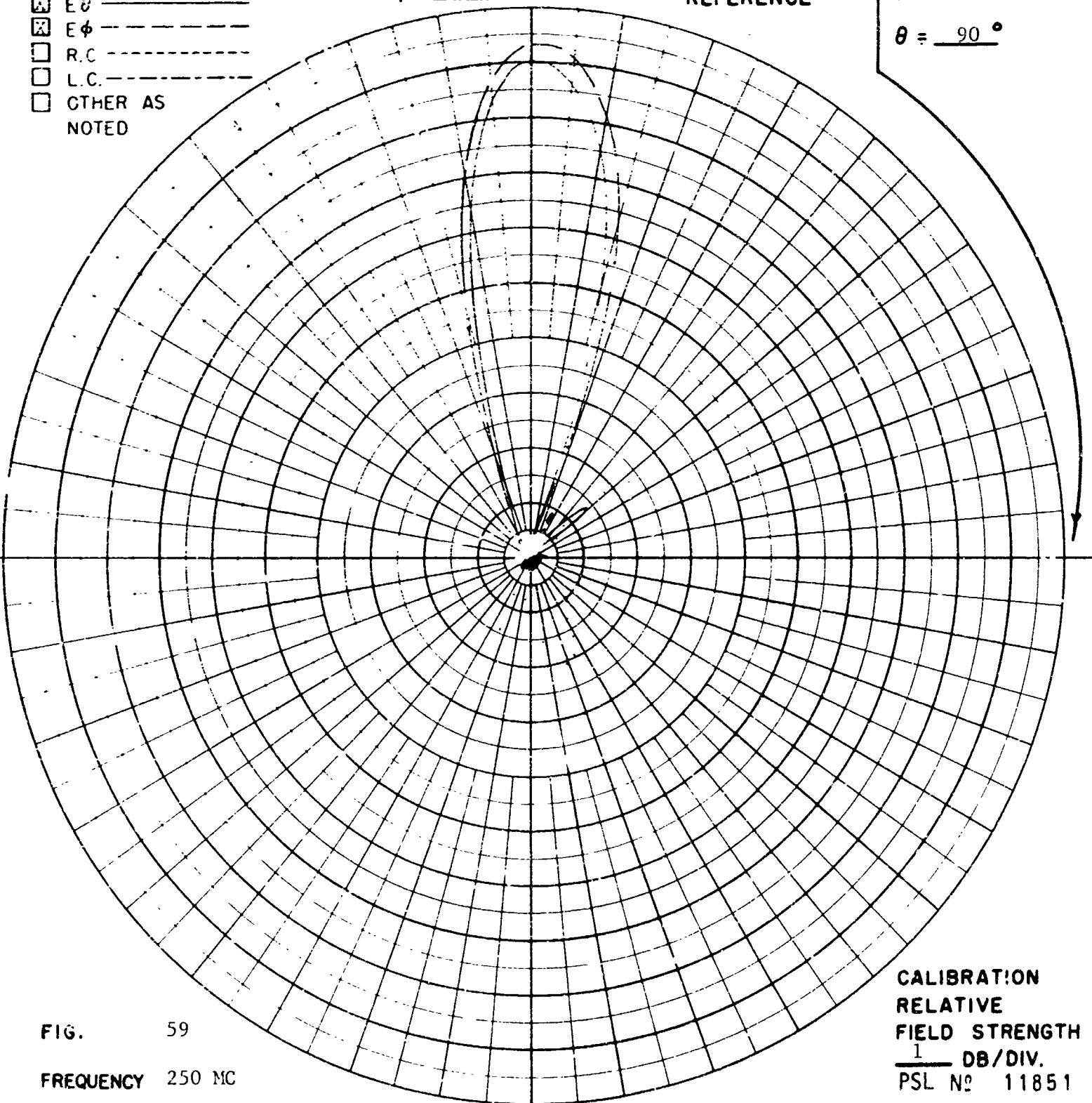


FIG. 59

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11851

POLARIZATION

- GAIN REF -----
- E_θ -----
- E_φ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}^{\circ} 60^{\circ}$

$\theta = \underline{\hspace{2cm}}^{\circ} 90^{\circ}$

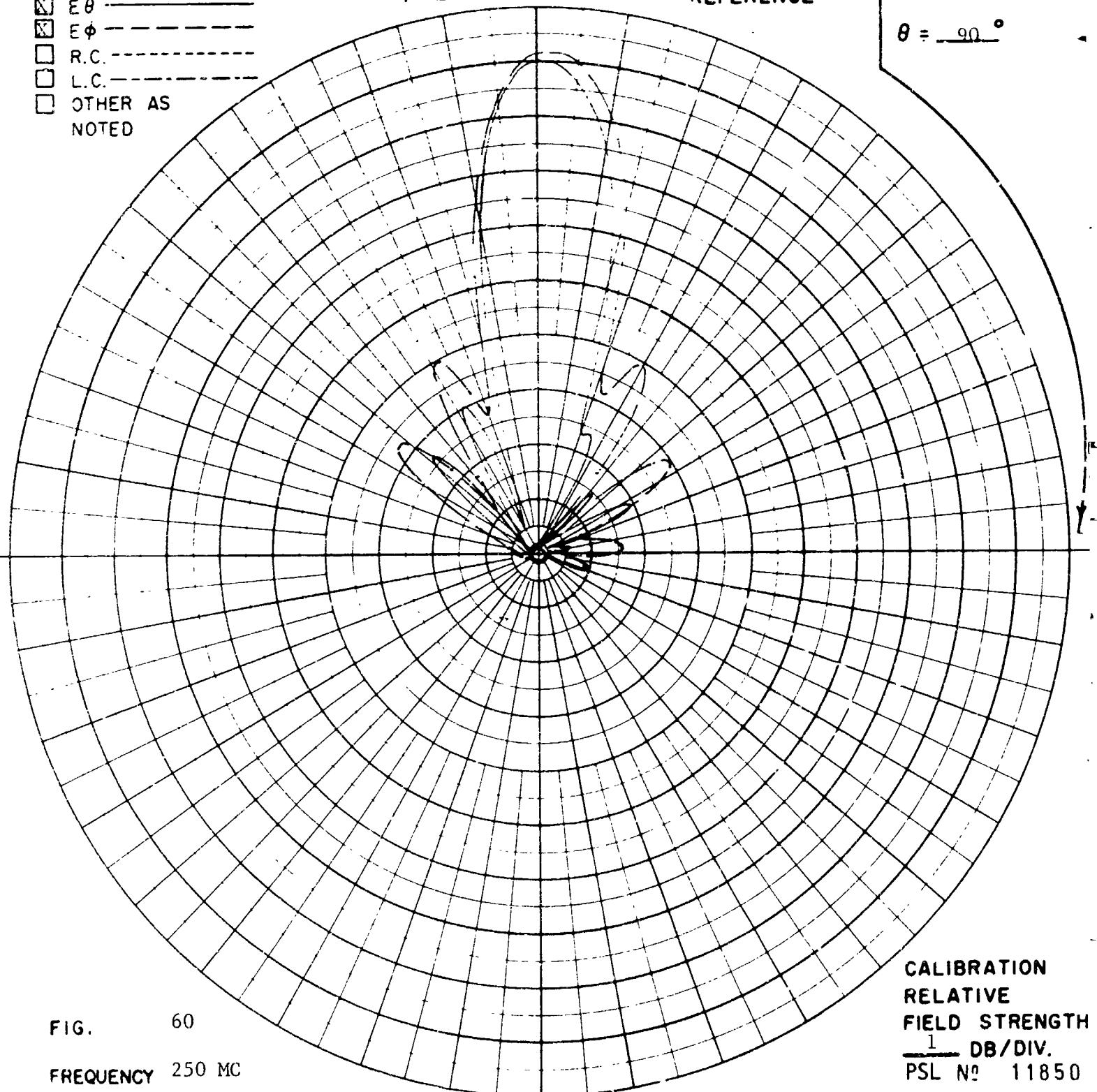


FIG. 60

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11850

POLARIZATION

- GAIN REF - - - -
 E θ _____
 E ϕ - - - -
 R.C. - - - -
 L.C. - - - -
 OTHER AS
NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °
 $\theta = \underline{\hspace{2cm}}$ °

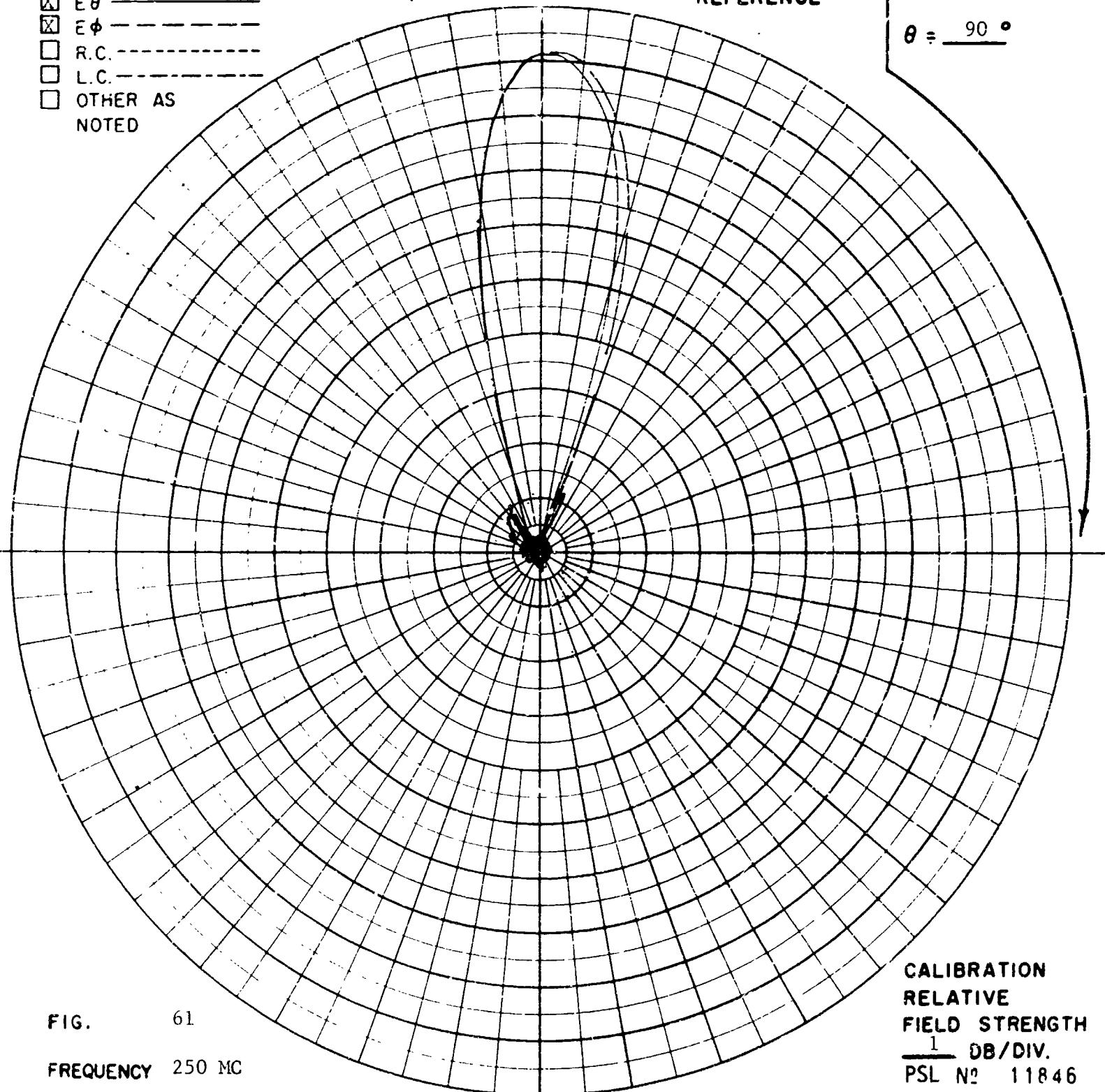


FIG. 61

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11846

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}^{\circ}$ $\theta = \underline{\hspace{2cm}}^{\circ}$ COORDINATE
REFERENCE

$\phi = \underline{120}^{\circ}$
 $\theta = \underline{90}^{\circ}$

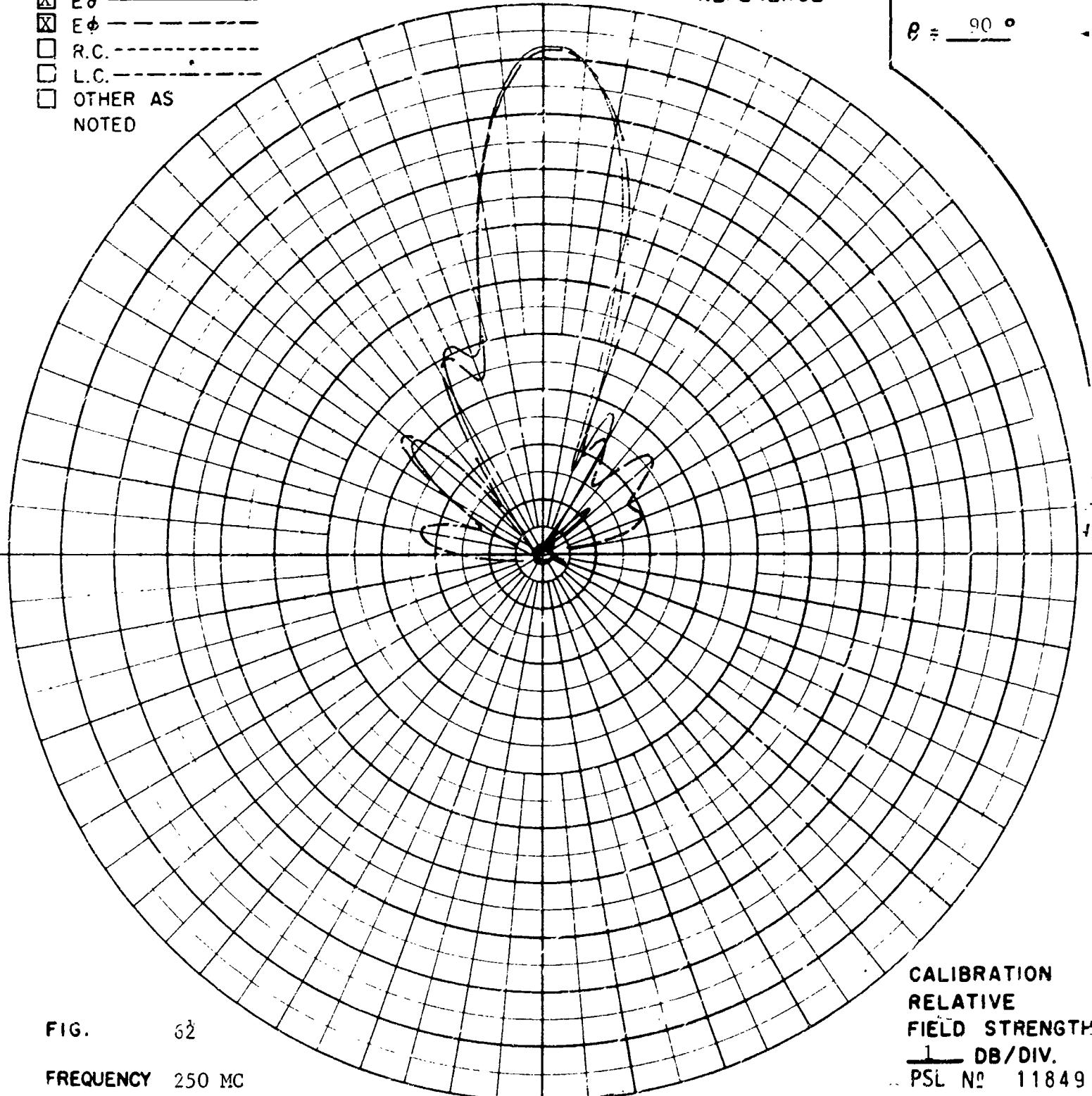


FIG. 62

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

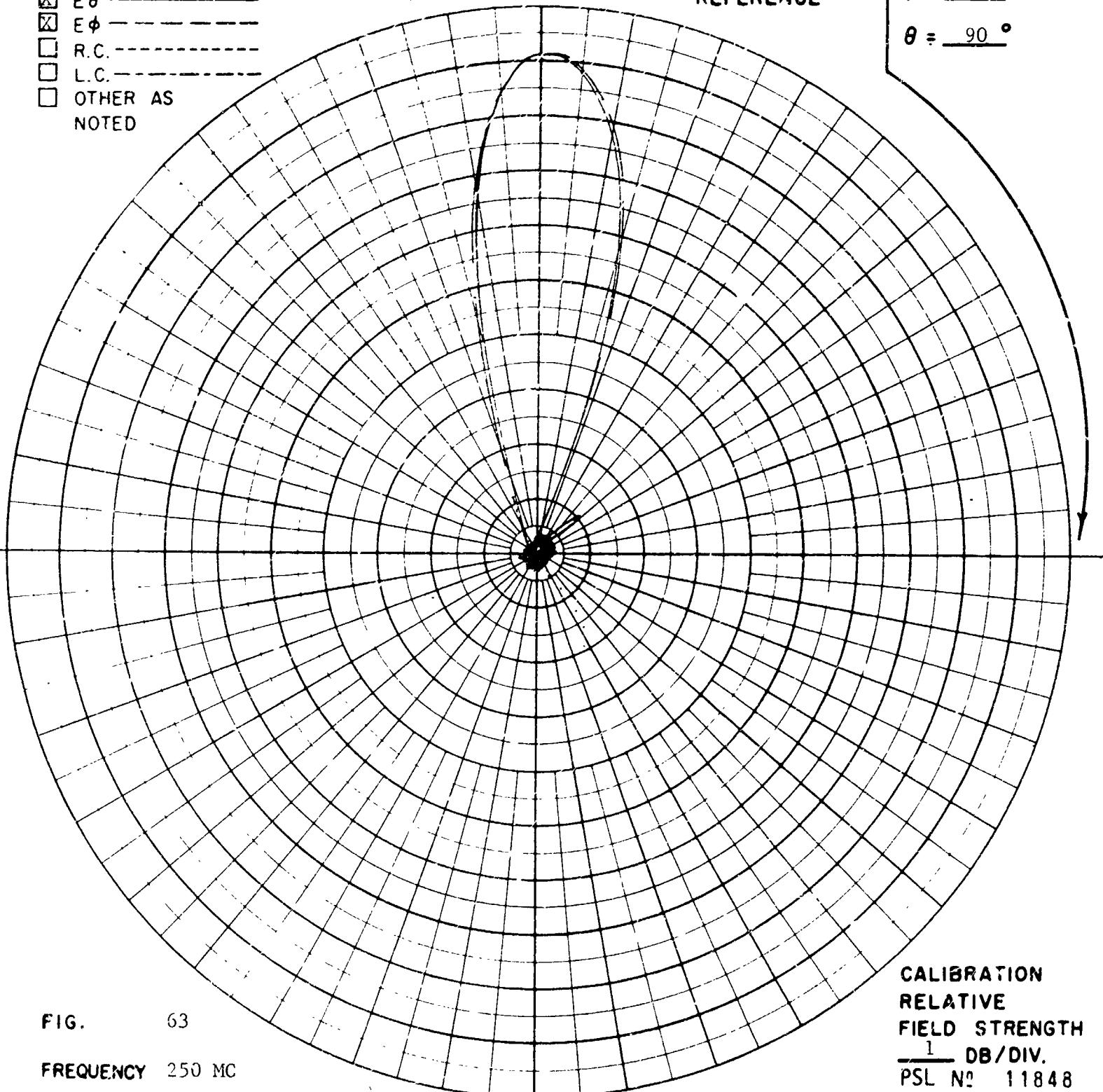
CALIBRATION
RELATIVE
FIELD STRENGTH
1 DB/DIV.
PSL N° 11849

POLARIZATION

- GAIN REF -----
- E θ -----
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ ° COORDINATE
REFERENCE

$\phi = \underline{150}$ °
 $\theta = \underline{90}$ °



CALIBRATION
RELATIVE
FIELD STRENGTH
 $\frac{1}{\text{DB/DIV.}}$
PSL N° 11848

FIG. 63

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

POLARIZATION

- GAIN REF -----
- E θ _____
- E ϕ -----
- R.C. -----
- L.C. -----
- OTHER AS NOTED

$\phi = \underline{\hspace{2cm}}$ ° $\theta = \underline{\hspace{2cm}}$ °

COORDINATE
REFERENCE

$\phi = \underline{\hspace{2cm}}$ °

$\theta = \underline{\hspace{2cm}}$ °

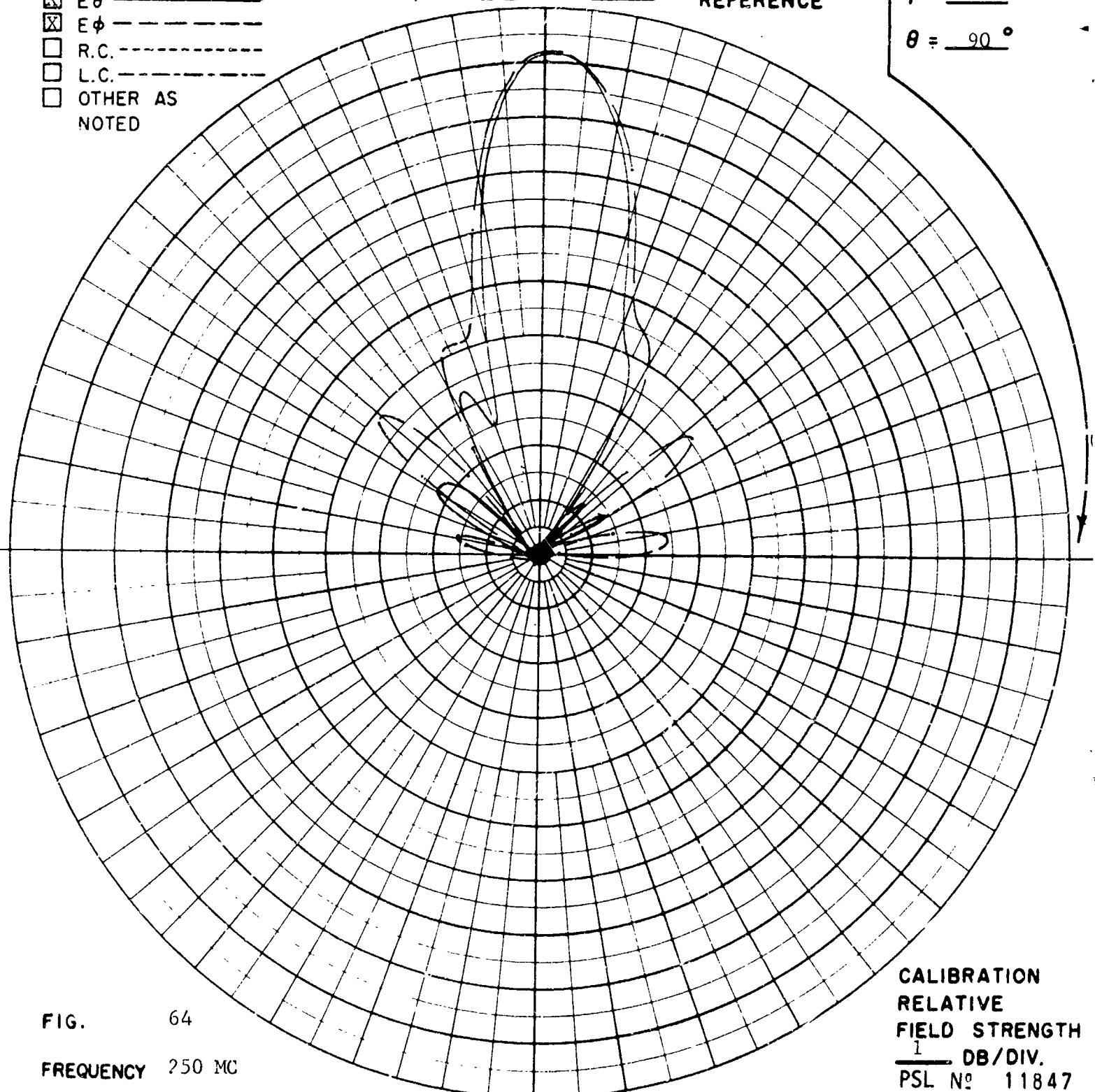


FIG. 64

FREQUENCY 250 MC

ANTENNA TRI - HELIX ARRAY

REMARKS

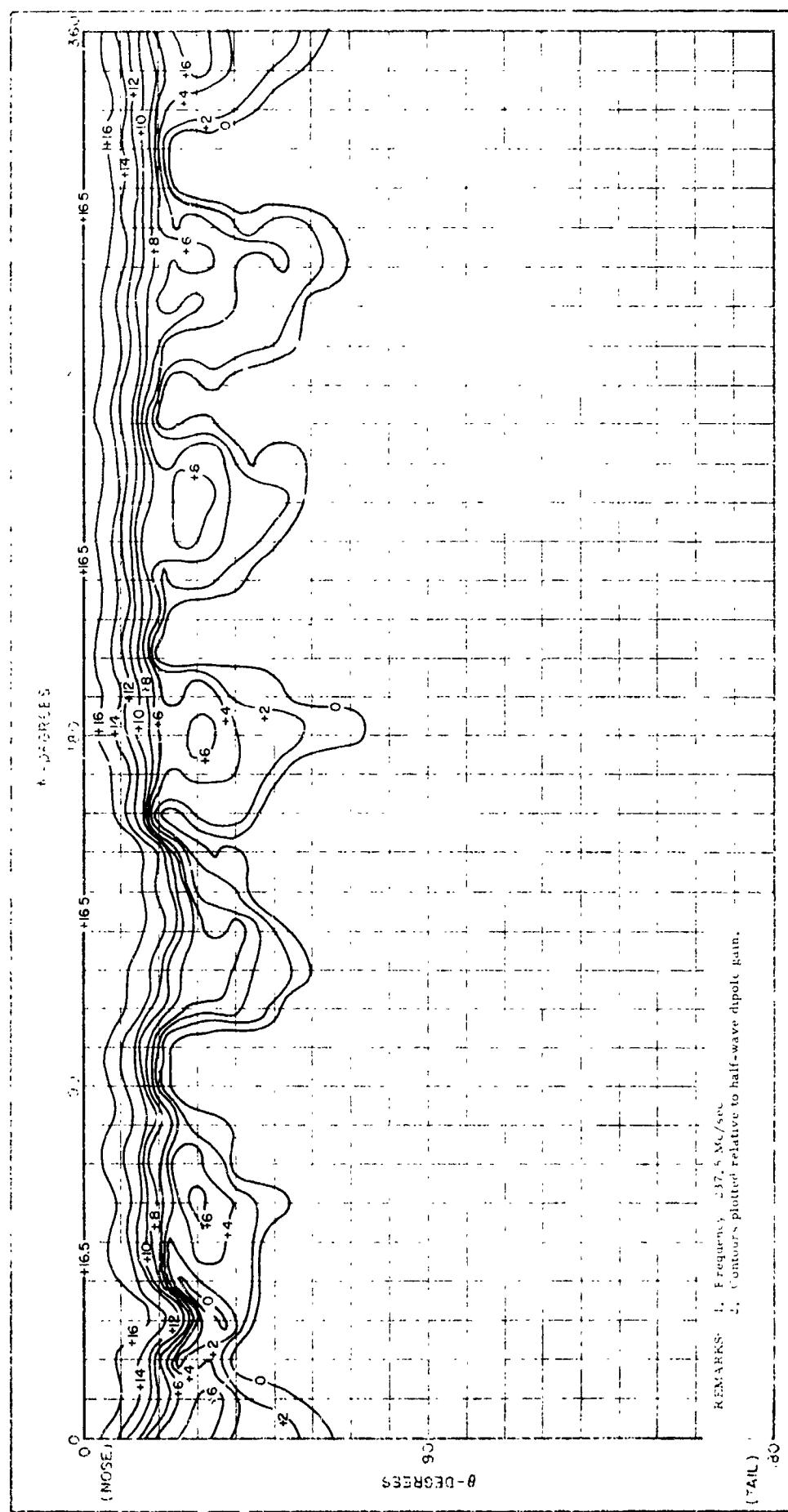


FIG. 65 - RADIATION PATTERN POWER CONTOURS FOR CIRCULAR POLARIZATION - RIGHT CIRCULAR

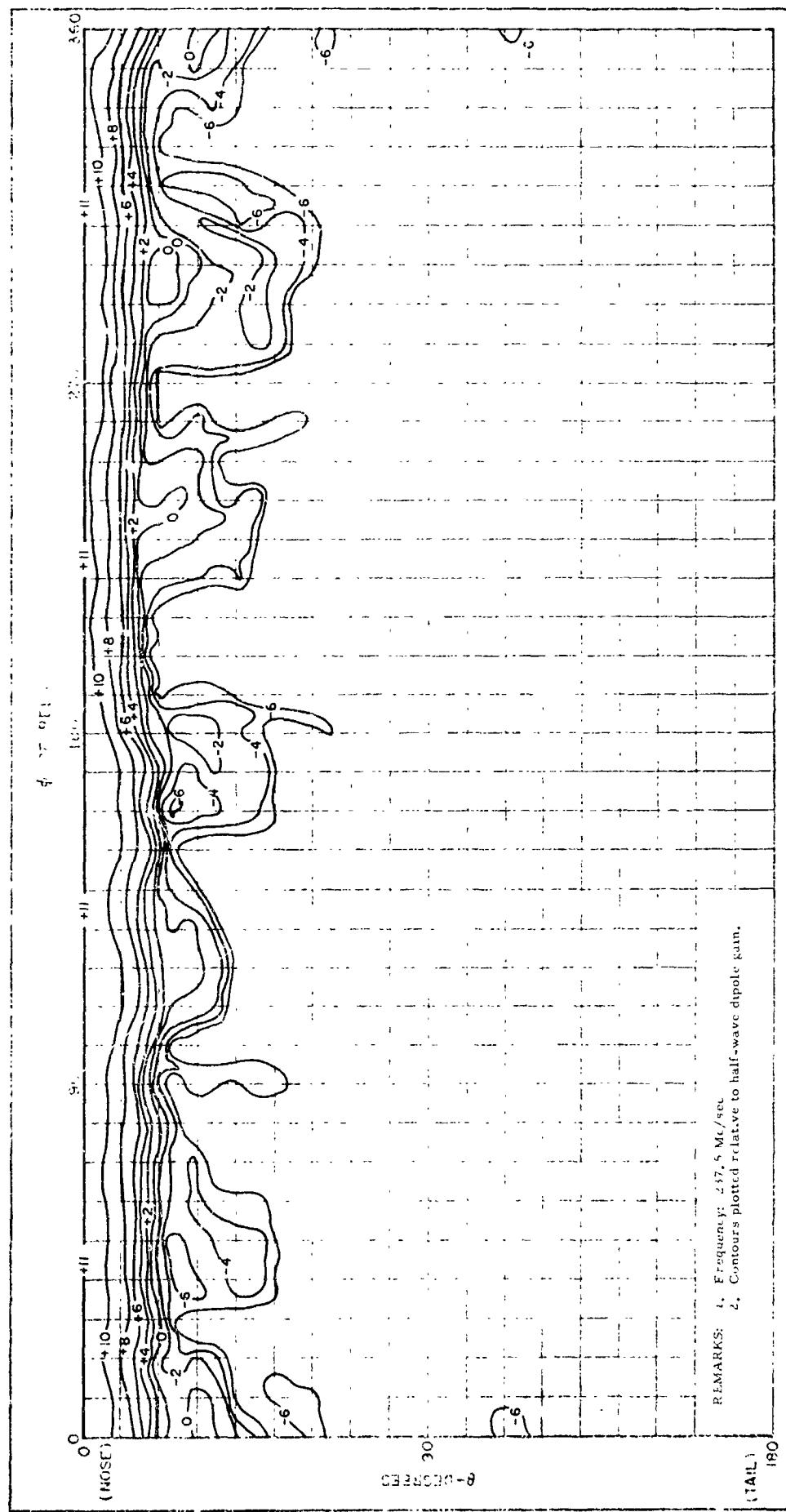


FIG. 66 - RADIATION PATTERN POWER CONTOURS FOR LINEAR POLARIZATION - E_θ

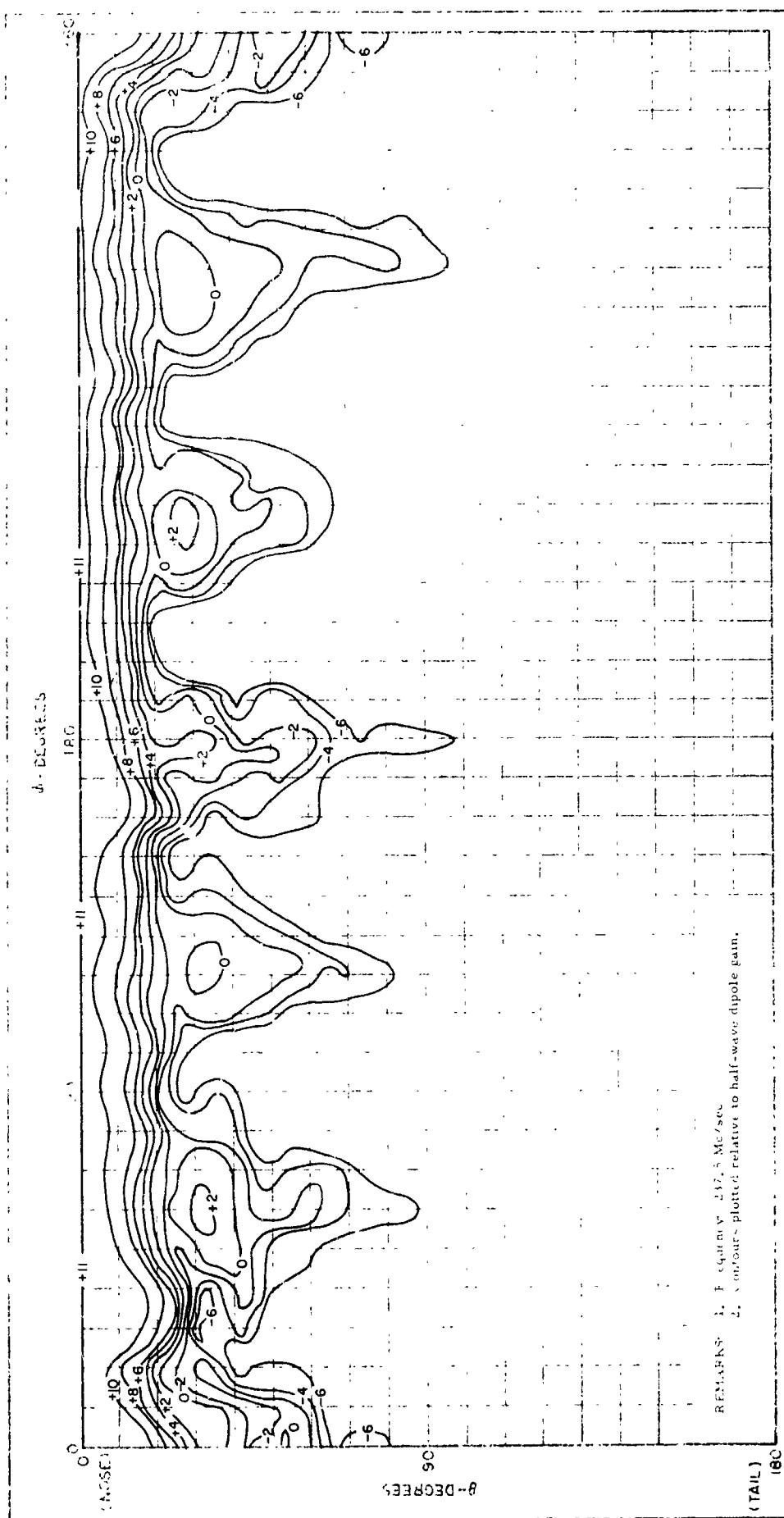


FIG. 67 - RADIATION PATTERN POWER CONTOURS FOR LINEAR POLARIZATION - E_ϕ

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

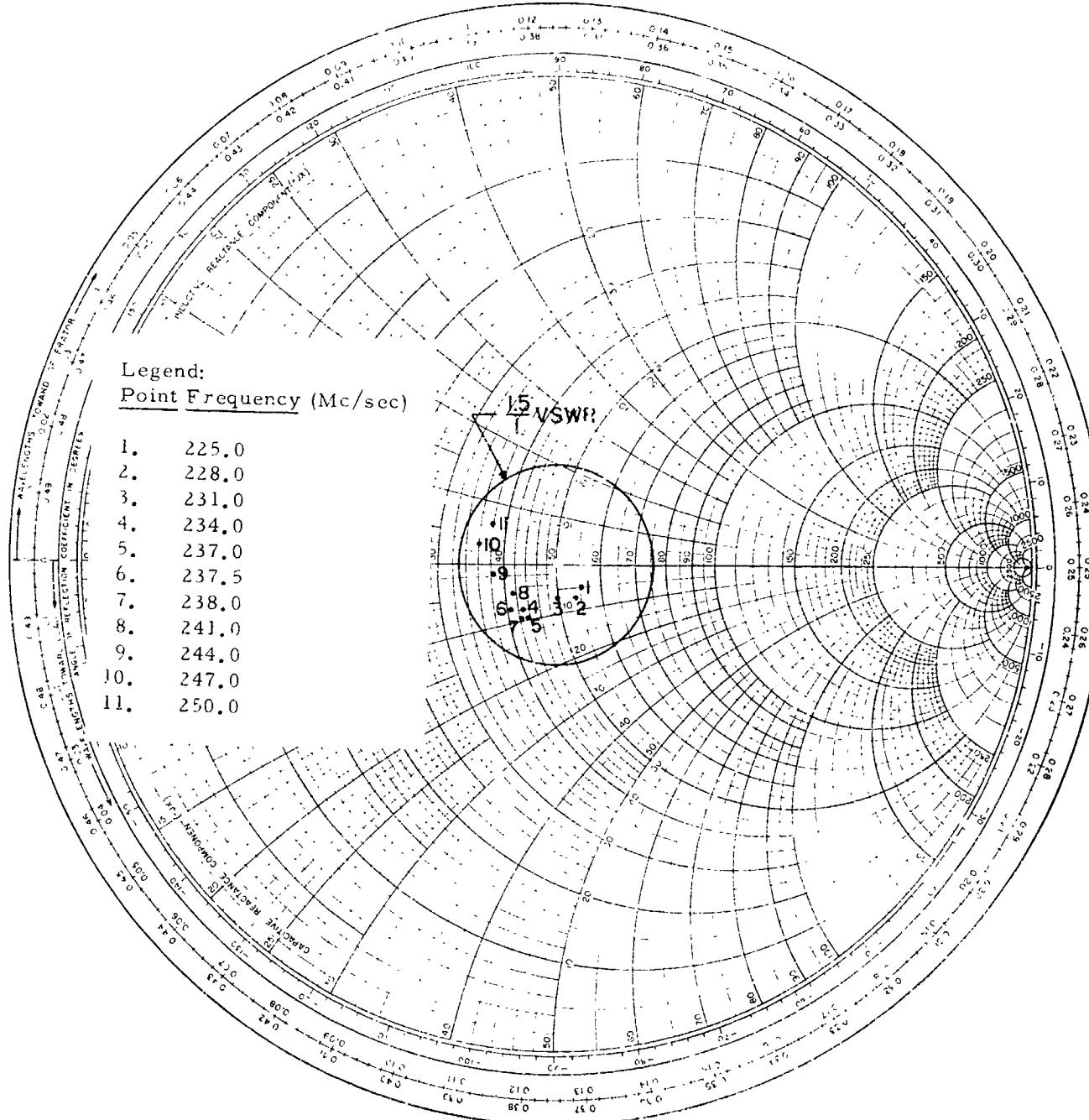


FIG. 68 - IMPEDANCE OF TOTAL CONNECTED TRI-HELIX ARRAY
AT POWER DIVIDER INPUT

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

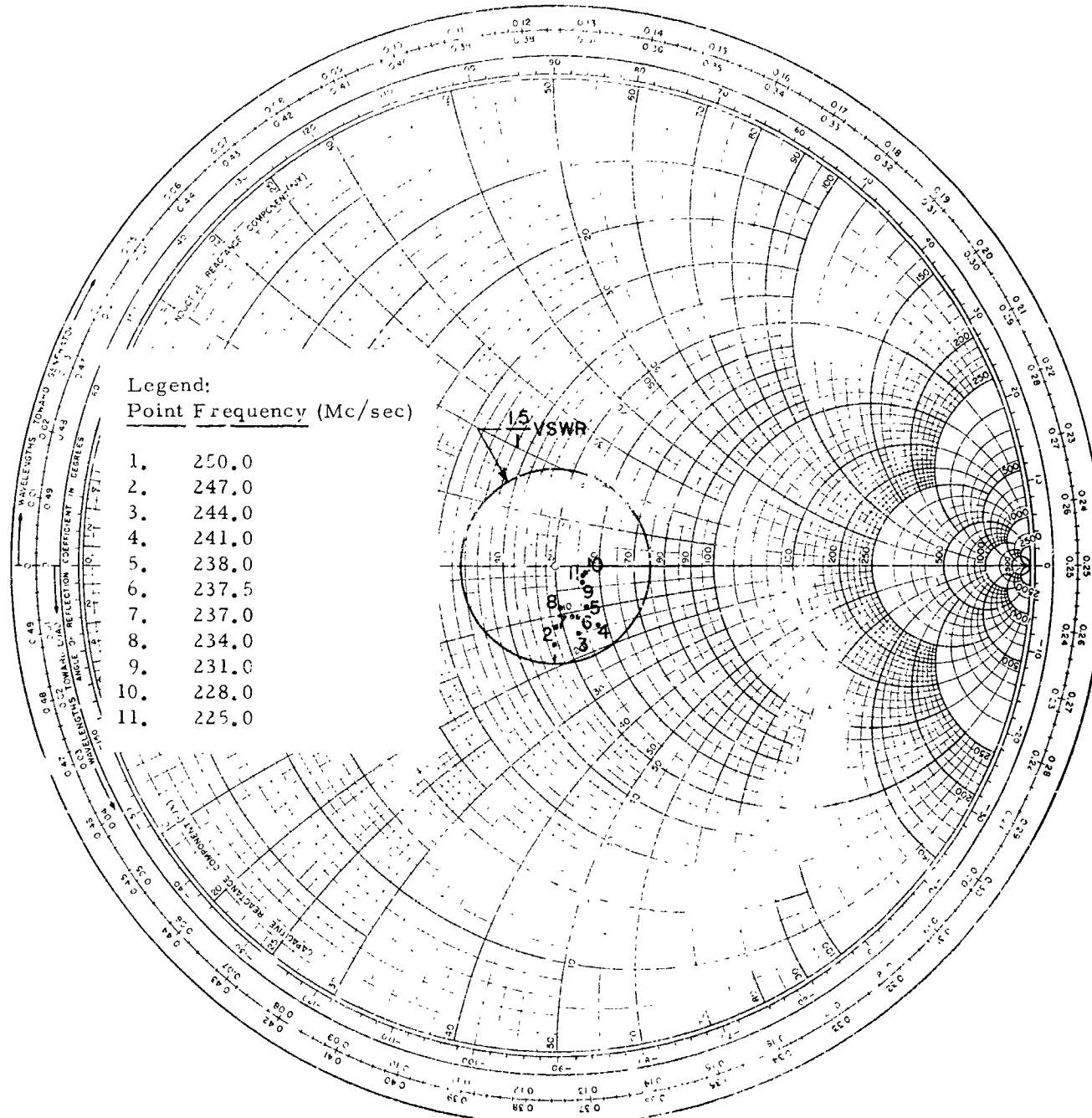


FIG. 69 - IMPEDANCE AT FOAMFLEX COAXIAL TRANSMISSION LINE INPUT TO ANTENNA NO. 1

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

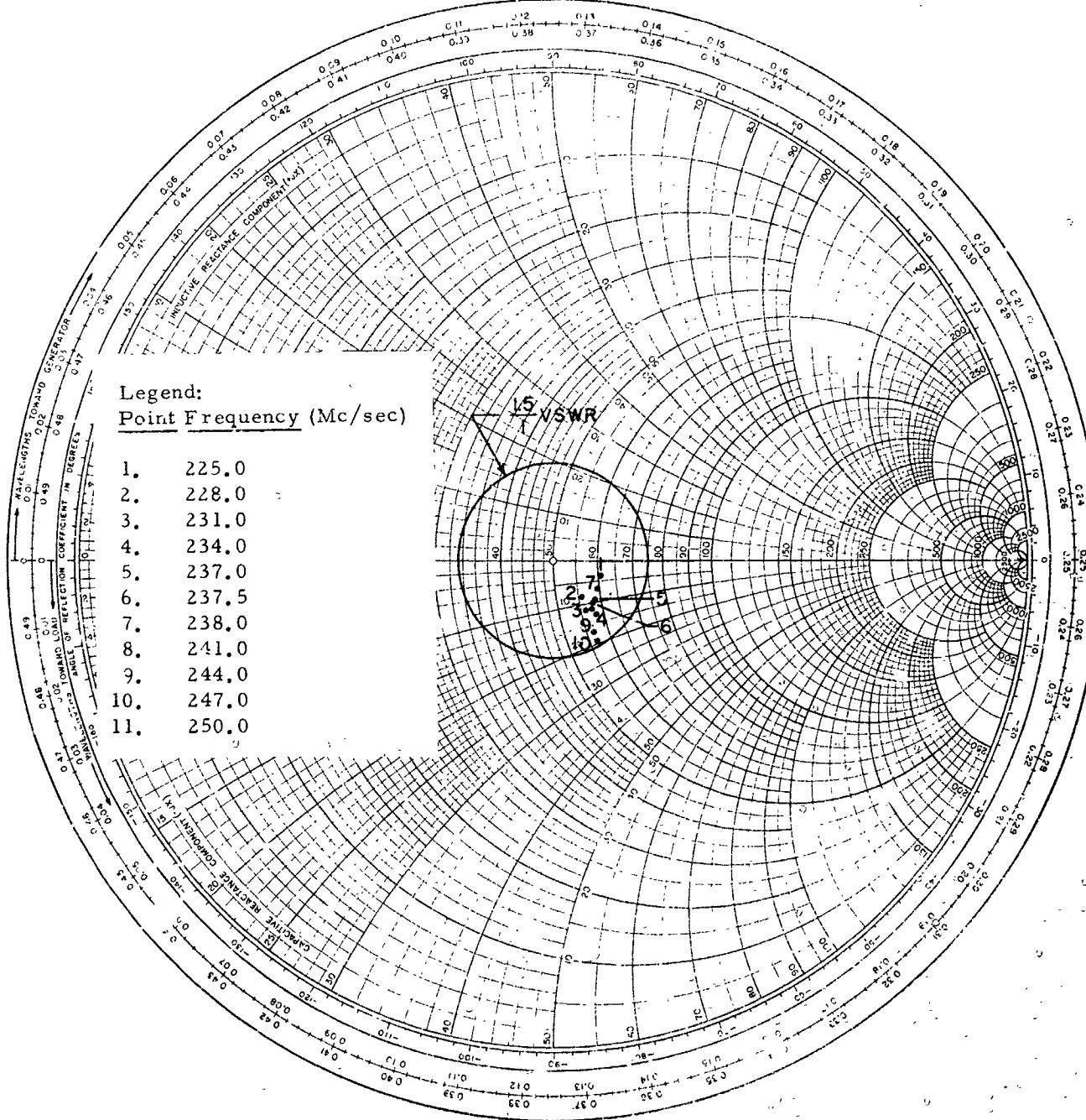


FIG. 70 - IMPEDANCE AT FOAMFLEX COAXIAL TRANSMISSION
LINE INPUT TO ANTENNA NO. 2

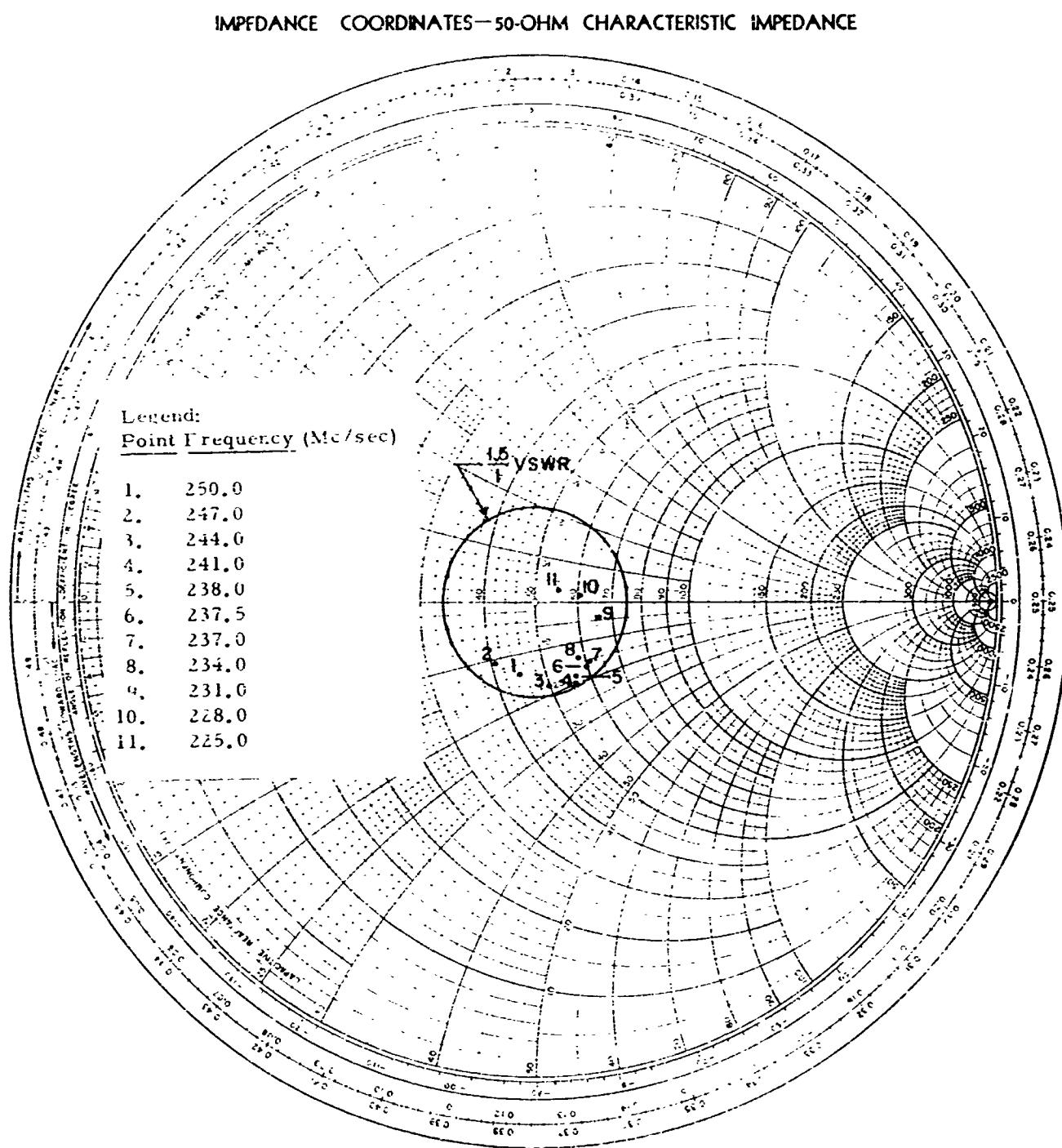


FIG. 71 - IMPEDANCE AT FOAMFLEX COAXIAL TRANSMISSION
LINE INPUT TO ANTENNA NO. 3

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

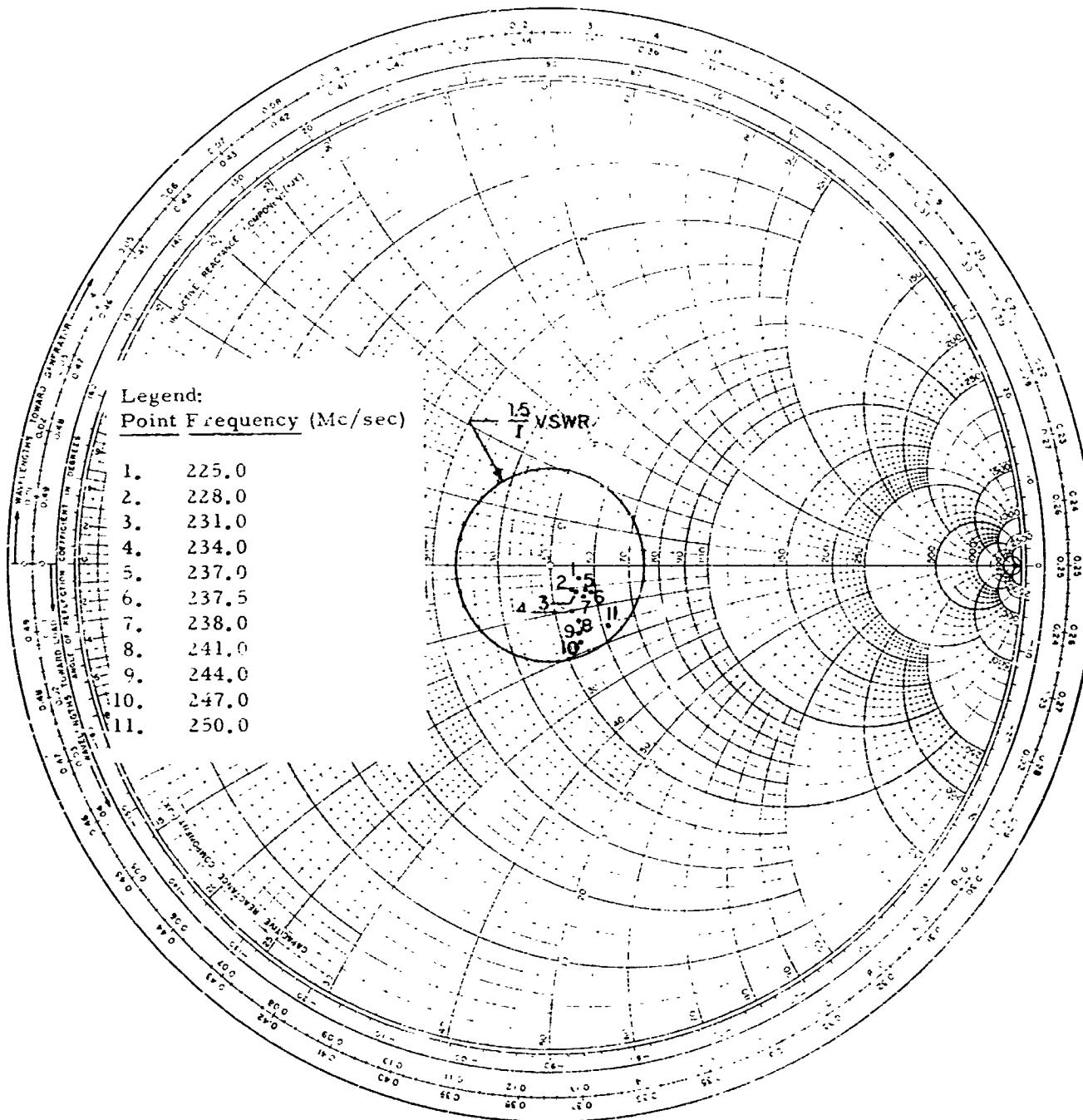


FIG. 72 - IMPEDANCE AT TRANSFORMER INPUT TO ANTENNA NO. 1

IMPEDANCE COORDINATES—50-OHM CHARACTERISTIC IMPEDANCE

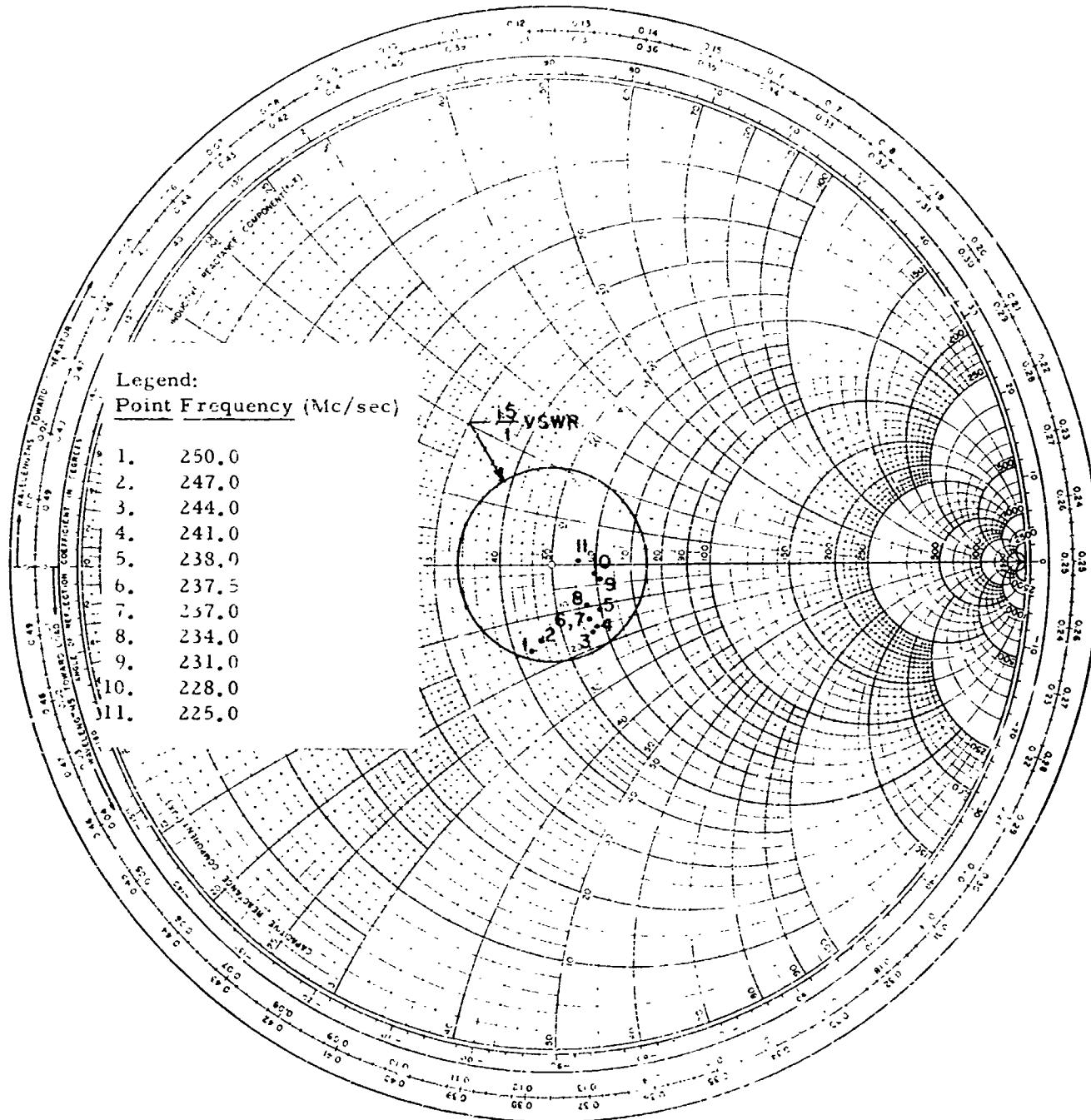


FIG. 73 - IMPEDANCE AT TRANSFORMER INPUT TO ANTENNA NO. 2

IMPEDANCE COORDINATES--50-OHM CHARACTERISTIC IMPEDANCE

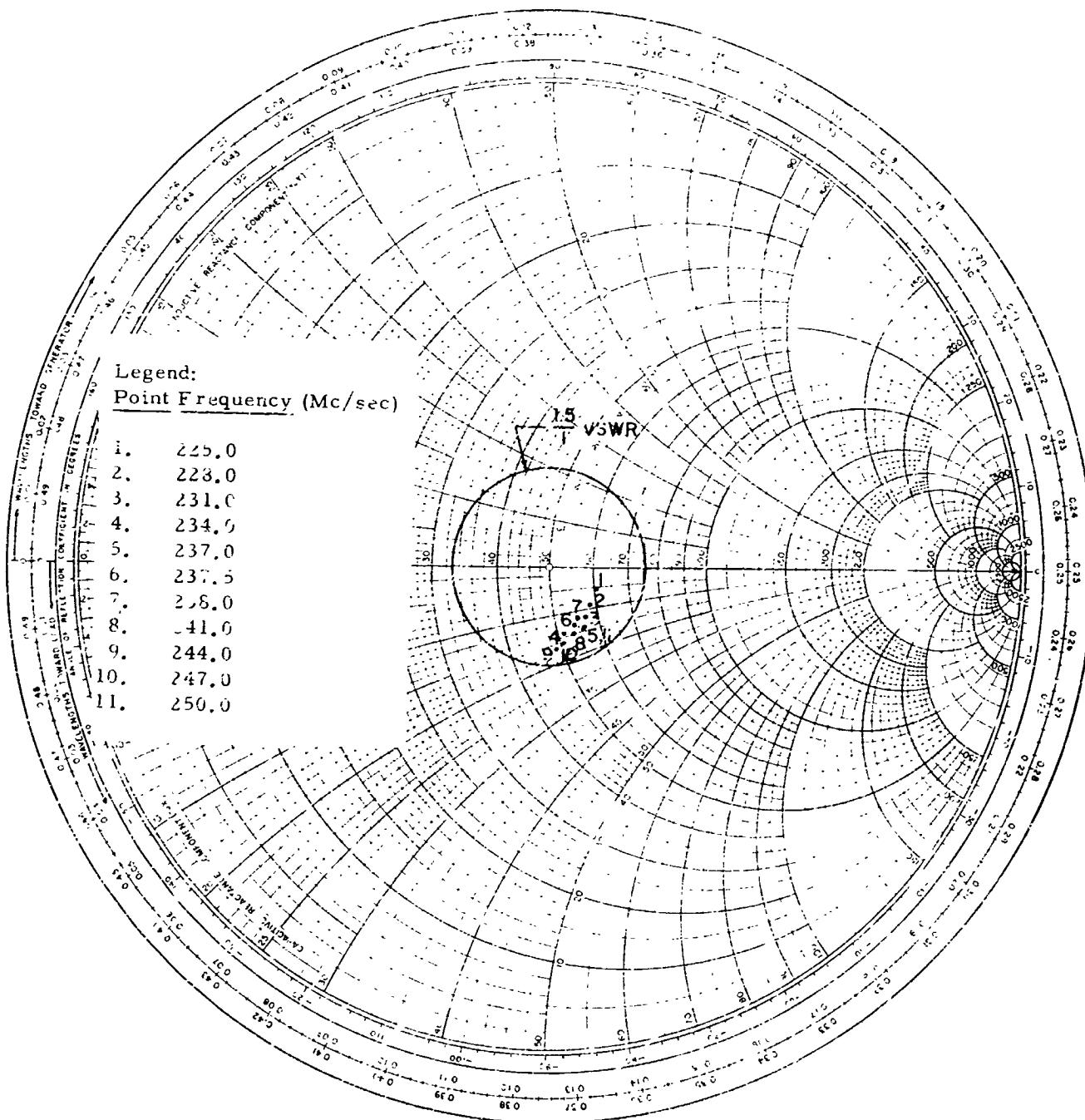


FIG. 74 - IMPEDANCE AT TRANSFORMER INPUT TO ANTENNA NO. 3

IMPEDANCE OR ADMITTANCE COORDINATES

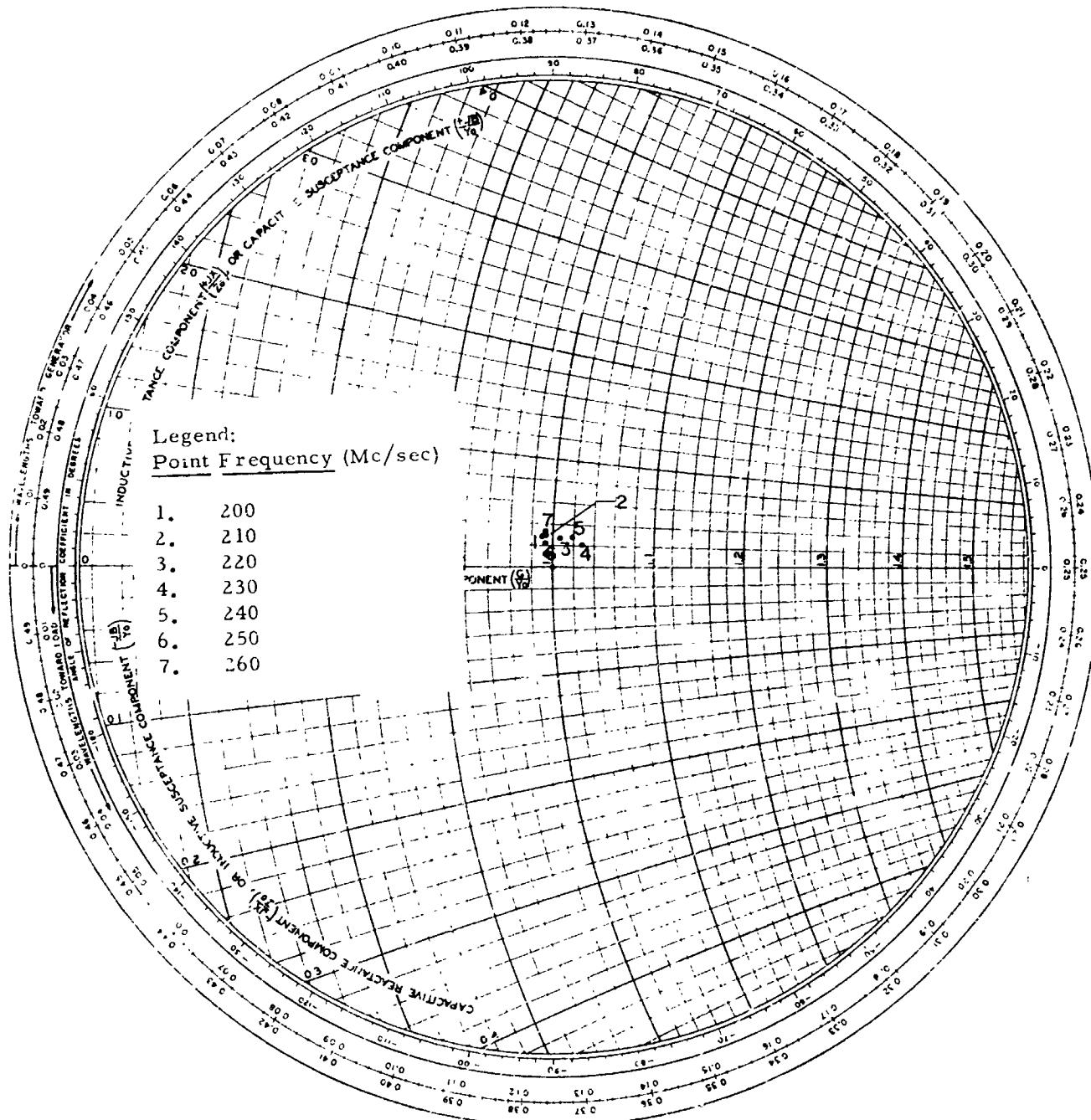


FIG. 75 - IMPEDANCE AT POWER DIVIDER INPUT WITH ANTENNA TRANSMISSION LINES REPLACED BY 50-OHM TERMINATIONS

APPENDIX

LIST OF PSL DRAWINGS OF 225 TO 250 MC/SEC TRI-HELIX ARRAY

DRAWING NUMBER	TITLE
004491	Tri-Helix Assembly
004187	Ground Plane Assembly
004088-2	Ground Plane Sub-Assembly
004065-1	Truss Assembly
004068-3	Angle
004069-3	Angle
004072	Plate
004073-2	Plate
004075	Plate
004065-2	Truss Assembly
004068-4	Angle
004069-4	Angle
004072	Plate
004073-2	Plate
004075	Plate
004067	Truss Assembly
004070	Angle
004071	Angle
004072	Plate
004074	Plate
004075	Plate
004084-1	Angle
004084-2	Angle

DRAWING NUMBER	TITLE
004086-1	Angle
004086-2	Angle
004083-3	Angle
004086-5	Angle
004087-1	Angle
004087-2	Angle
004087-3	Angle
004087-5	Angle
003993	Plate Center
004091-1	Angle
004091-2	Angle
004118-2	Plate Transformer Mount
004092-2	Support Mast
004182-2	Plate Transformer Mount
004485	Brace
3/4 - No. 051	Grating, Flattened Expand-X
AN-960-616	Washer Flat 3/8 Cadmium Plate
No Number	Strip 1/8 x 1/2 Stock
No Number	Screw Round HD No. 8-32 x .50LG
No Number	Nut Hex No. 8-32
No Number	Bolt Hex HD 3/8-16 x 1.00 LG
004089-2	Ground Plane Sub-Assembly
004065-1	Truss Assembly

DRAWING NUMBER	TITLE
004068-3	Angle
004069-3	Angle
004072	Plate
004073-2	Plate
004075	Plate
004065-2	Truss Assembly
004068-4	Angle
004069-4	Angle
004072	Plate
004073-2	Plate
004075	Plate
004067	Truss Assembly
004070	Angle
004071	Angle
004072	Plate
004074	Plate
004075	Plate
004085-1	Angle Assembly
004093	Angle
No Number	Angle 1 3/4 x 1 3/4 x 1/8
004085-2	Angle Assembly
004093	Angle
No Number	Angle 1 3/4 x 1 3/4 x 1/8

DRAWING NUMBER	TITLE
004086-1	Angle
004086-2	Angle
004086-3	Angle
004086-5	Angle
004087-1	Angle
004087-2	Angle
004087-3	Angle
004087-5	Angle
003993	Plate Center
004091-1	Angle
004091-2	Angle
004092-2	Support Mast
004485	Brace
3/4 - No. 051	Grating Flattened Expand-X
AN-960-616	Washer Flat 3/8 Cadmium Plate
No Number	Strip 1/8 x 1/2 Stock
No Number	Screw Round HD No. 8-32 x .50 LG
No Number	Nut Hex No. 8-32
No Number	Bolt Hex HD 3/8-16 x 1.00 LG
004174-2	Ground Plane Sub-Assembly
004065-1	Truss Assembly
004068-3	Angle
004069-3	Angle

DRAWING NUMBER	TITLE
004072	Plate
004073-2	Plate
004075	Plate
004065-2	Truss Assembly
004068-4	Angle
004069-4	Angle
004072	Plate
004073-2	Plate
004075	Plate
004067	Truss Assembly
004070	Angle
004071	Angle
004072	Plate
004074	Plate
004075	Plate
004084	Angle
004085-1	Angle Assembly
004093	Angle
No Number	Angle 1 3/4 x 1 3/4 x 1/8
004086-1	Angle
004086-2	Angle
004086-3	Angle
004086-5	Angle

DRAWING NUMBER	TITLE
004087-1	Angle
004087-2	Angle
004087-3	Angle
004087-5	Angle
004091-1	Angle
004091-2	Angle
003993	Plate Center
004118-2	Plate Transformer Mount
004485	Brace
3/4 No. 051	Grating Flattened Expand-X
No Number	Strip 1/8 x 1/2 Stock
No Number	Screw Round HD No. 8-32 x .50 LG
No Number	Nut Hex No. 8-32
004147-2	Feed Point Assembly
004237	Center Conductor
004238	Center Conductor
004239-2	Center Conductor
004236	Transformer Cap
001526-9	Spacer
004175	Tubing
004201-2	Tubing
004189	Collar
004240	Cable Jack Assembly

DRAWING NUMBER	TITLE
No Number	Cable Jack
No Number	Collar
004269	Support Feed Point
004479-4	Plate
004479-5	Plate
004479-6	Plate
004874	Support Feed Point
004047	Center Support Assembly
004047-1	Plate
004047-3	Plate
No Number	Screw Round HD No. 10-24 x .50 LG
No Number	Nut Hex No. 10-24
No Number	Bolt Hex HD 3/8-16 x 1.00 LG
No Number	Nut Hex 3/8-16
No Number	Screw Round HD No. 8-32 x .375 LG
No Number	Nut Hex No. 8-32
No Number	Screw Round HD No. 8-32 x 1.25 LG
No Number	Bolt Hex AD 1/4-20 x .50 LG
No Number	Washer Plain 3/8 Cadmium Plate
No Number	Screw Round HD No. 6-32 x .375 LG
No Number	Screw Round HD No. 8-32 x .625 LG
004119-2	Helix Assembly
004141	Base Mast

DRAWING NUMBER	TITLE
004142	Cap Mast
004143	Connector Feed Point
004176	Mast Helix
004145-2	Stand Off Helix
004172	Plug Helix
665	Lacing Cord STD
No Number	Tubing .25 O.D x .032 Wall
No Number	Screw Round HD No. 6-32 x 7/16 LG
No Number	Screw Round HD No. 10-32 x 7/16 LG
No Number	Screw Socket Set Cup PT No. 6.32 x .125 LG
004146	Nut
D2-A97	Power Divider (Special Design)
004489-2	Transmission Line Assembly

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5. Inter-Range Instrumentation Group (IRIG), IRIG Standard Coordinate System and Data Format for Antenna Patterns, Document Number 102-61, September 1961.